Chapter 2: Project Alternatives and Description of the Preferred Alternative

2.1 INTRODUCTION

The proposed Hudson Tunnel Project (the Project or the Proposed Action) would consist of a new rail tunnel under the Hudson River (referred to as the Hudson River Tunnel), new surface tracks in New Jersey and railroad infrastructure connecting the new rail tunnel to the existing Northeast Corridor (NEC) in Secaucus, New Jersey and at Penn Station New York (PSNY), together with rehabilitation of the existing NEC tunnel beneath the Hudson River, known as the North River Tunnel. The primary purpose of the Project is to enable rehabilitation of the North River Tunnel without major disruptions to passenger rail service into and out of PSNY. In addition, when completed, the Project would result in a total of four tracks on the NEC from Secaucus, New Jersey, to PSNY with both the old and new tunnels in service. This would provide redundant capability and increased operational flexibility for the National Railroad Passenger Corporation (Amtrak) and the New Jersey Transit Corporation (NJ TRANSIT), which both operate passenger trains on the NEC between New Jersey and New York.

Since publication of the Draft Environmental Impact Statement (DEIS), the Preferred Alternative has been refined from what was presented in the DEIS as a result of design advancement and changes made in response to comments received on the DEIS. Amtrak has continued to advance the design of the Preferred Alternative, including incorporating design refinements based on further engineering analysis and information, resulting in some modifications to the design presented in the DEIS.

This chapter reflects the following changes made since the DEIS:

- A new discussion of additional alternatives considered after completion of the DEIS, including alternative construction methods and alternative approaches for rehabilitation of the North River Tunnel.
- Incorporation of design modifications related to the permanent features of the Project (e.g., modifications to surface tracks and tunnel alignment), as described in the Foreword in Section F.2.2.

In addition, following completion of the DEIS, the Port Authority of New York and New Jersey (PANYNJ) became the Project Sponsor for the Hudson Tunnel Project (see Chapter 1, “Purpose and Need,” Section 1.1.2, for more information). Consistent with the roles and responsibilities defined in Section 1.1.1, as the current Project Sponsor, the PANYNJ will comply with mitigation measures and commitments identified in the Record of Decision (ROD).

This chapter describes the two alternatives evaluated in this Environmental Impact Statement (EIS), the No Action Alternative and the Build Alternative, which is also the Preferred Alternative. It begins with an overview of the railroad operations through the North River Tunnel and at PSNY (Section 2.2). The chapter then provides a discussion of the alternatives development and evaluation process conducted to develop the Preferred Alternative (Section 2.3), followed by a discussion of the No Action Alternative (Section 2.4) and the Preferred Alternative (Section 2.5). Information on construction activities associated with the Preferred Alternative is provided in Chapter 3, “Construction Methods and Activities.” The description of the Preferred Alternative in this chapter includes the design modifications related to the permanent features of the Project

(e.g., modifications to surface tracks and tunnel alignment) that are presented in the Foreword to this EIS.

This chapter contains the following sections:

2.2 PROJECT SETTING: RAIL OPERATIONS IN THE NORTH RIVER TUNNEL AND PSNY COMPLEX

The existing North River Tunnel is a critical NEC asset and is the only intercity passenger rail crossing into New York City from New Jersey and areas west and south. It extends approximately 2.5 miles from its western portal in North Bergen, New Jersey, to its eastern portal at approximately Tenth Avenue in Manhattan, within the network of tracks leading to PSNY. Existing operations in the tunnel and at PSNY are discussed in this section.

2.2.1 NORTH RIVER TUNNEL

The North River Tunnel is the sole existing Hudson River crossing on the NEC, carrying Amtrak and NJ TRANSIT passenger rail service between New Jersey and PSNY. Amtrak operates high-speed Acela trains, Northeast Regional trains, and long-distance trains (i.e., Cardinal, Carolinian, Crescent, Keystone, Palmetto, Pennsylvanian, Silver Meteor, Silver Star, and Vermonter) through the North River Tunnel to and from PSNY. Four of NJ TRANSIT's electrified rail lines—NEC, North Jersey Coast Line, Morris and Essex Lines, and Montclair-Boonton Line—provide direct, one-seat ride service into PSNY during peak and off-peak periods. NJ TRANSIT also operates off-peak Raritan Valley Line trains through the North River Tunnel to and from PSNY.

The North River Tunnel has a maximum capacity of 24 trains per hour in the peak direction in the peak hour. Trains operate at a maximum speed of 60 miles per hour (mph) in the tunnel, dropping to a maximum of 15 mph entering and leaving PSNY. The complexities of the track network leading into and out of PSNY (discussed below in Section 2.2.2) and the high volume of train movements in the PSNY complex often reduce trains speeds further, as trains wait for other trains to cross or for open platforms. Prior to the COVID-19 global pandemic, the tunnel was

heavily used throughout the day, with a total of about 500 trains per day in both directions on weekdays and close to 300 trains per day on weekend days, despite a reduced schedule of weekend train service to allow maintenance in the tunnel. Even with reduced train service due to the pandemic, the tunnel is still heavily used throughout the day.

The North River Tunnel consists of two separate single-track tunnels, or tubes, which are collectively referred to as one tunnel. It begins at the western slope of the steep ridge known as the Palisades in North Bergen, New Jersey. The tunnel's western portal (entrance point) is just east of Tonnelle Avenue in North Bergen. From that portal, the tunnel continues beneath the Palisades, Weehawken, and the Hudson River. In Manhattan, it crosses through the foundation of the existing Hudson River bulkhead (the seawall along the Manhattan waterfront), continues beneath the Metropolitan Transportation Authority (MTA) Long Island Rail Road (LIRR) John D. Caemmerer West Side Yard, a large railyard between Twelfth Avenue (also known as Route 9A) and Tenth Avenue. The North River Tunnel's eastern terminus is a portal just east of Tenth Avenue, where the tracks merge into the below-grade approach tracks to PSNY.

The North River Tunnel is more than 100 years old and was designed and built to early 20th century standards. As described in Chapter 1, "Purpose and Need," service reliability through the tunnel, already suboptimal because of the tunnel's age and antiquated design, has been further compromised because of the damage to tunnel components caused by Superstorm Sandy. The storm inundated both tubes of the tunnel with seawater above the height of the bench walls at the tunnel's lowest point, and deposited chlorides which remain in the tunnel's concrete liner (i.e., the inner lining of the tunnel), bench walls (the low walls on both sides of the track in each tube which provide walkways and contain utility conduits), and ballast, causing ongoing damage to tunnel components.

Since Superstorm Sandy, Amtrak has been undertaking ongoing repairs to the tunnel. This involves scheduled work during evening off-peak periods as well as full closure of one tube on many weekends for a 55-hour window beginning on Friday evening and ending early on Monday morning. To allow for these regular maintenance activities, Amtrak and NJ TRANSIT operate with an adjusted, reduced schedule on weekends. This revised schedule has substantially fewer trans-Hudson trains than the regular weekend schedule prior to the adjustment and constrains NJ TRANSIT's ability to serve current customer demand for weekend travel. Additional emergency maintenance, required when tunnel components fail, has been necessary with increasing frequency since Superstorm Sandy and it disrupts service for hundreds of thousands of rail passengers throughout the region.

In 2020, Amtrak began the North River Tunnel Interim Reliability Improvements Program to accelerate immediate maintenance and repair in the tunnel prior to its full rehabilitation. Through that program, Amtrak is examining options for a variety of repairs and improvements to the North River Tunnel with the goal of improving safety and reliability for the public over the next decade in advance of comprehensive rehabilitation. Amtrak expects that targeted interventions developed through this program can temporarily mitigate many of the maintenance issues in the North River Tunnel that result in train delays and may accomplish limited permanent repairs, but they cannot deliver the comprehensive rehabilitation of the North River Tunnel contemplated as part of the Hudson Tunnel Project and necessary for the long-term preservation and safe use of the tunnel. Through the use advanced testing and innovative scanning techniques developed as part of the Interim Reliability Improvements Program, Amtrak will obtain better information about the condition of the tunnel that will inform ongoing maintenance in the tunnel as well as the design for the full rehabilitation of the North River Tunnel that will follow.

2.2.2 PSNY OPERATIONS

Figure 2-1 illustrates the general layout of the tracks at the PSNY complex, including the station platforms, the approach tracks west of PSNY, the existing North River Tunnel portal, and the complex of rail storage tracks west of the station.

PSNY has a total of 21 tracks and 11 platforms. During peak operations, Amtrak uses Tracks 5 through 12, NJ TRANSIT uses Tracks 1 through 12, and LIRR uses Tracks 13 through 21. During off-peak operations, Amtrak and NJ TRANSIT also use Tracks 13 through 16. Track and platform usage is dictated by use agreements[1] between the three railroads and also by track connections that provide access to the various tunnels, tracks, and platforms. Trains move between the North River Tunnel and passenger platforms via ladder tracks that provide connections to each of the platform tracks. In addition, Amtrak's Empire Corridor trains, which travel through Manhattan along the east side of the Hudson River, enter PSNY via a single-track tunnel west of the station in Manhattan connecting to 4 of the 21 station tracks. The North River Tunnel has direct connections to the center platform tracks at PSNY; Ladder Tracks U and M connect to the platform tracks in the southern portion of PSNY, generally used by NJ TRANSIT, and Ladder Tracks G and I provide connections between the North River Tunnel and platform tracks in the northern portion of PSNY.

West of PSNY, the blocks between Tenth Avenue and Twelfth Avenue from West 30th to West 34th Street are occupied by the PSNY approach tracks and rail storage yards. LIRR uses the largest, the West Side Yard, for midday storage of trains. In addition, the PSNY rail complex includes several smaller rail storage yards—including A Yard, D Yard, and E Yard—between Eighth and Tenth Avenues that NJ TRANSIT, and occasionally by Amtrak, use for midday storage of trains, for overnight storage and servicing of trains, and for operational flexibility.

East of PSNY, the station's Tracks 5 through 21[2] converge into four tracks running beneath midtown Manhattan and then to Queens through the four tubes of the East River Tunnels, which provide access to LIRR's network through Queens and Nassau and Suffolk Counties and to Amtrak's Hell Gate Line through Queens and the Bronx to New England. The East River Tunnels also provide access to the Sunnyside Yard railyard complex in Queens, which Amtrak uses for maintenance and storage of trains. NJ TRANSIT also uses tracks in Sunnyside Yard for midday storage of its trains.

In the morning peak period, eastbound trains from New Jersey drop off passengers at the platforms of PSNY and then either reverse for westward service (or move westward out of the station without passengers) or continue eastward to Sunnyside Yard in Queens (for NJ TRANSIT) and beyond (for Amtrak). In the evening peak period, the process is reversed. Empty New Jersey-bound trains come into PSNY from Sunnyside Yard (in non-revenue service) or from New Jersey (generally in revenue service), to collect passengers bound for New Jersey (for NJ TRANSIT), or come from points east and north (for Amtrak) for service heading west and south on the NEC. PSNY currently operates at capacity during the peak periods—there is no additional capacity to process trains at the platforms, given the time required for trains to wait at the platform for passengers to board and alight, and to move through the station. In addition, no capacity is available to route additional trains through the East River Tunnels for either passenger (i.e., revenue) service or for midday storage in Sunnyside Yard, and there is limited

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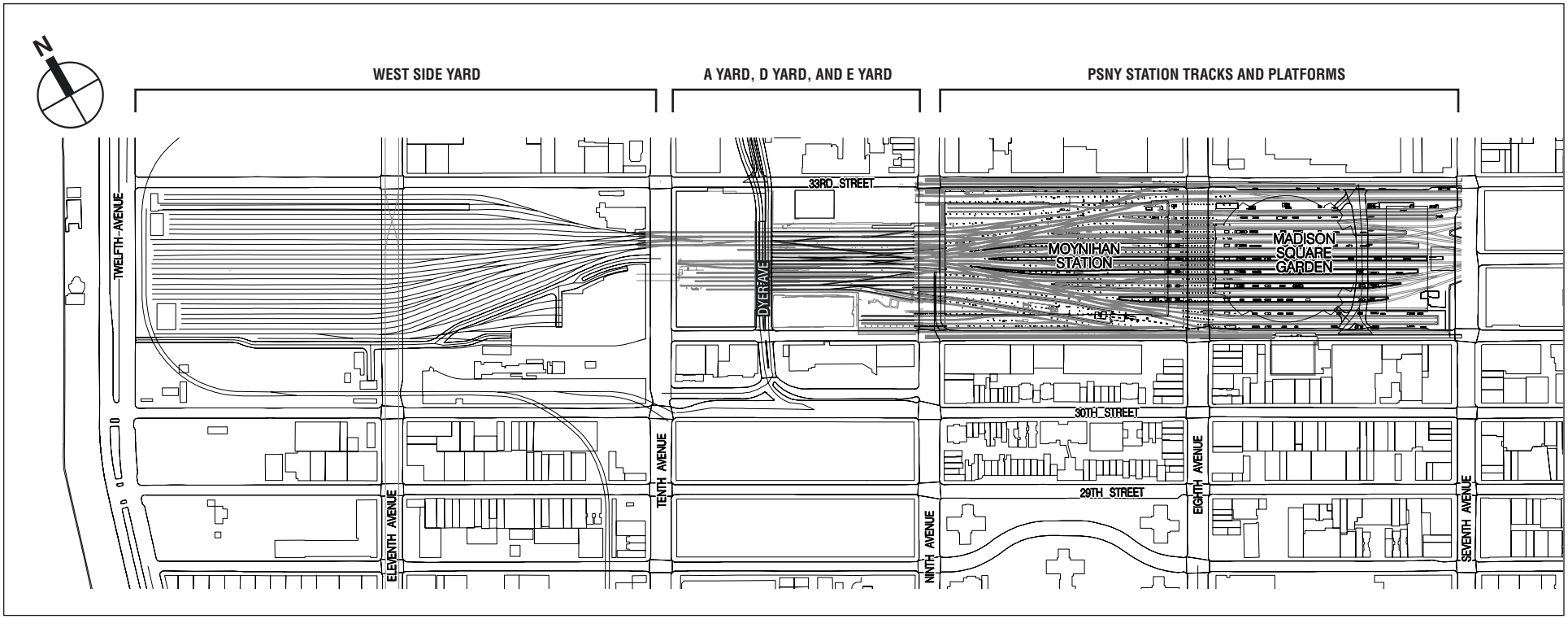
[1] Track and platform use agreements in place include the Joint Venture Agreement between LIRR and Amtrak; and the NEC Services Agreement (an operating agreement), and Slot Agreement (proscribing allowable trains per hour/per peak period) between NJ TRANSIT and Amtrak.

[2] Tracks 1 through 4 are stub-ended and do not connect to the East River Tunnels; these tracks are used exclusively by NJ TRANSIT.



HUDSON TUNNEL PROJECT

PSNY Rail Complex

Figure 2-1

storage capacity within the PSNY complex. In the future, without any projects to improve the capacity of PSNY, train operations in the station will remain at the same level as they are today.

A number of future projects are currently being implemented or planned that will affect the PSNY rail complex and rail operations through PSNY. These projects will occur independently of the Hudson Tunnel Project and therefore will occur with the No Action Alternative as well as with the Preferred Alternative. Those projects are described in Chapter 4, "Analysis Framework," Section 4.3.3.1, and in Chapter 5B, "Transportation Services," Section 5B.4.1.1.

2.3 ALTERNATIVES DEVELOPMENT AND PROCESS USED TO IDENTIFY THE PREFERRED ALTERNATIVE

As described in Chapter 1, "Purpose and Need," the purpose of the Proposed Action is to preserve the current functionality of Amtrak's NEC service and NJ TRANSIT's commuter rail service between New Jersey and PSNY by repairing the deteriorating North River Tunnel, and to strengthen the NEC's resiliency to support reliable service by providing redundant capability under the Hudson River for Amtrak and NJ TRANSIT NEC trains between New Jersey and PSNY. These improvements must be achieved while maintaining uninterrupted commuter and intercity rail service and by optimizing the use of existing infrastructure.

The Federal Railroad Administration (FRA) and NJ TRANSIT conducted a multi-step alternatives development and evaluation process to identify Build alternatives that meet the purpose and need for the Project. As the result of this process, two alternatives were identified for analysis in this EIS: the No Action Alternative and a single Build Alternative, which is the Preferred Alternative. The alternatives evaluation process involved developing an initial list of preliminary alternatives, comprising many different possible means of providing a Hudson River rail crossing, and conducting a high-level qualitative evaluation to determine which of those alternatives were feasible, reasonable, and met the Proposed Action's purpose and need. The result of that evaluation was a single Build Alternative concept with a range of potential alignment options. These potential alignment options were then evaluated against a more detailed set of quantitative and qualitative criteria to determine which alignment option best meets the Project purpose, need, goals, and objectives. The identified alignment option was incorporated into the Build Alternative for the Hudson Tunnel Project.

Section 2.3.1 summarizes the alternatives development process that FRA and NJ TRANSIT conducted. A detailed description of the alternatives development and evaluation process is provided in the "Hudson Tunnel Project Alternatives Development Report," April 2017, included in **Appendix 2** of this EIS.

Section 2.3.2 describes additional analyses of potential alternatives that FRA and NJ TRANSIT conducted after completion of the DEIS.

2.3.1 DEVELOPMENT AND EVALUATION OF PRELIMINARY ALTERNATIVES

FRA and NJ TRANSIT's initial step in the development and evaluation of alternatives for the Project was to compile a list of preliminary alternatives based on prior studies for a new Hudson River rail crossing, including the Access to the Region's Core (ARC) Project's Major Investment Study (MIS), DEIS, Supplemental DEIS (SDEIS), and Final Environmental Impact Statement (FEIS); possible alternatives presented in the Hudson Tunnel Project's Scoping Document; and input received during the Project's scoping period (see Chapter 25, "Agency Coordination and Public Involvement," for a discussion of the scoping process for the Hudson Tunnel Project). **Table 2-1** lists the 15 alternatives that were developed and evaluated in the screening of preliminary alternatives.

The preliminary alternatives were evaluated against a two-tiered set of criteria:

- First, each alternative was assessed for its ability to meet purpose and need, including Project goals and objectives as well as established design criteria (i.e., engineering and operational factors).
- Alternatives that were found to meet purpose and need were then assessed in terms of feasibility (i.e., whether the alternative can feasibly be constructed and operated given engineering, constructability, and rail operations considerations) and reasonableness (i.e., an alternative may not be reasonable if it would have a likelihood for substantial impacts, a protracted construction time, an unacceptably high cost or great environmental impact relative to other alternatives, or operational characteristics that are unacceptable).

Alternatives that were found to meet the Project purpose and need and to be feasible and reasonable were carried forward for further development and evaluation. Information on those alternatives and the screening evaluation is summarized in the "Hudson Tunnel Project Alternatives Development Report," April 2017, provided in **Appendix 2** of this EIS. **Table 2-1** below summarizes the results of the screening evaluation. The screening evaluation concluded that the only Build Alternative concept that meets both of the established criteria is a new two-track rail tunnel near the existing North River Tunnel, with rehabilitation of the existing tunnel. FRA and NJ TRANSIT dismissed other alternatives because they did not meet the Project purpose and need or because they were found to be infeasible or unreasonable. Alternatives that did not meet the Project purpose and need had constraints related to either (1) connecting from the NEC into the existing tracks at PSNY, or (2) maintaining uninterrupted NEC service and functionality. In some cases (i.e., the various alternatives that were considered for the ARC Project), discrete elements of eliminated alternatives were included as part of the Preferred Alternative.

As a result of the preliminary screening process, FRA and NJ TRANSIT retained the No Action Alternative and a single Build Alternative for further evaluation in the EIS.

Table 2-1
Screening Evaluation of Preliminary Alternatives

Alternative	Evaluation	Result
No Action Alternative	Required by National Environmental Policy Act (NEPA)	Carried forward for analysis in EIS
ARC Major Investment Study (MIS) alternatives	Do not meet purpose and need for the Project	Eliminated
ARC Scoping and DEIS alternatives	Some components of the ARC DEIS Build Alternative meet purpose and need for the Project and are feasible and reasonable; other components do not	Relevant components that do meet the Project purpose and need integrated into Build Alternative for the Project
ARC Supplemental DEIS/Final EIS Build Alternative	Some components of the ARC SDEIS/FEIS Build Alternative meet purpose and need for the Project; other components do not and/or are not feasible	Relevant components that do meet the Project purpose and need integrated into Build Alternative for the Project
Build Alternative components presented in Scoping Document: new tunnel connecting to PSNY approach tracks	Meets purpose and need for the Project and is feasible and reasonable	Carried forward for further development and evaluation
Alternatives for Manhattan terminal options	Does not meet purpose and need for the Project	Eliminated; not precluded by Project and can be evaluated in a separate, future project
Alternative connections in Secaucus	Does not meet purpose and need for the Project	Eliminated; not precluded by Project and can be evaluated in a separate, future project
Alternative with additional station in New Jersey	Does not meet purpose and need for the Project	Eliminated; not precluded by Project and can be evaluated in a separate, future project
Alternative southern routing	Could meet the purpose and need for the Project but is not reasonable and is potentially infeasible	Eliminated
Alternative routing near Hoboken Terminal	Could meet the purpose and need for the Project but is not reasonable	Eliminated
Shared passenger and freight rail tunnel	Does not meet purpose and need for the Project and is not reasonable or feasible	Eliminated
Shared passenger rail tunnel and No. 7 subway line	Does not meet purpose and need for the Project, is not reasonable, and may be infeasible	Eliminated
Passenger rail tunnel with bicycle lane	Does not meet purpose and need for the Project and is infeasible	Eliminated
New tunnel with single track / phased tunnel construction	Does not meet purpose and need for the Project and is not reasonable	Eliminated
Bridge alternative	Does not meet purpose and need for the Project, is not reasonable, and is likely infeasible	Eliminated
Rehabilitation of portions of the North River Tunnel tubes	Does not meet purpose and need for the Project	Eliminated
Rehabilitation of both North River Tunnel tubes at the same time	Does not meet purpose and need for the Project	Eliminated

2.3.2 REFINED SCREENING: EVALUATION OF ALIGNMENT OPTIONS

2.3.2.1 BUILD ALTERNATIVE ALIGNMENT

The single Build Alternative concept consists of a new tunnel carrying the NEC between New Jersey and PSNY, together with rehabilitation of the North River Tunnel. The new alignment would include two new surface tracks branching off from and running alongside the existing NEC

just east of Frank R. Lautenberg Secaucus Junction Station in New Jersey, entering a tunnel through a portal in North Bergen (just south of the existing portal for the North River Tunnel), continuing in a tunnel beneath the Palisades[3] and the Hudson River, and connecting to the existing approach tracks that lead into PSNY.

To accommodate train operations for Amtrak and NJ TRANSIT trains, the Build Alternative's tunnel would need to meet the following design requirements:

- The tunnel must have a grade (slope) of no more than 2.1 percent, needed for efficient and reliable operation of Amtrak and NJ TRANSIT passenger trains.[4]
- Design speed of 60 to 80 miles per hour (mph), consistent with the tunnel's terminus at the junction of numerous intersecting tracks approaching or exiting PSNY. The tunnel may support 80 mph operation in some areas, but peak period trains would typically operate at a maximum of 60 mph under normal conditions.
- Maintain, at a minimum, the existing eastbound capacity into PSNY at the Tenth Avenue portal of 24 trains per hour, with a signal design system that can accommodate 30 trains per hour in both directions at Tenth Avenue in Manhattan in the future, to accommodate long-term plans for increased capacity at PSNY. (Note that implementation of the Preferred Alternative would not result in the higher rail capacity, since other infrastructure investments need to be made, including at PSNY and elsewhere on the NEC. For more information on the capacity limitations of PSNY, see Chapter 1, "Purpose and Need," Section 1.2.4.)
- A 130-foot-wide vertical shaft from the surface to the tunnel close to the Hudson River on each side of the river, to facilitate construction of the tunnel and then to serve as a permanent ventilation shaft and emergency egress point (please see Section 2.5.2.6 for a discussion of the proposed ventilation system).[5]
- The tunnel must provide appropriate clearances for Amtrak and NJ TRANSIT passenger trains and enough space for egress and maintenance walkways (bench walls or otherwise), high-voltage feeder cables (and associated enclosure), signal and communications cables, overhead contact system (to provide electric power to the trains), and ventilation plenums.[6] This requires tunnels with an inside diameter of approximately 25 feet and an outer diameter of approximately 28 feet.

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[3] The Palisades are a line of steep cliffs that run along the western side of the Hudson River from northeastern New Jersey into southern New York State. In North Bergen and Union City, the Palisades are approximately 300 feet above the land to their west and east.

[4] Given the train lengths (and resulting weight) of NJ TRANSIT's commuter trains serving PSNY, this is the steepest grade for NJ TRANSIT's trainsets in terms of operational reliability.

[5] During construction of the tunnel, vertical shafts would provide direct access for tunneling operations. These shafts must be large in diameter (approximately 130 feet) to provide access to both tubes of the tunnel. For tunneling operations, these shafts would be used for demobilization and servicing of tunnel boring machines; access of crews, equipment, and materials for cross passage construction; and in Manhattan, for access of crews, equipment, and materials for construction of the adjacent tunnel sections. Given the geologic conditions on both sides of the river near the waterfront, which at shallower levels include soils that are not strong materials, these large shafts must be adequately supported to provide safe, stable working conditions for the construction crews, equipment, and materials, which is most effectively achieved by a vertical structure. These same vertical shafts would then be used as permanent tunnel ventilation shafts because they would provide the shortest direct connection from the tunnels to the associated fan plant buildings and ventilation system equipment located above the tunnels. This would minimizes Project cost and the space required for the ventilation system, which in turn would reduce necessary real estate acquisitions.

[6] A plenum is a chamber that houses air flow as part of a ventilation system.

To meet the Project purpose and need, the Build Alternative must maintain current levels of train service on the NEC for Amtrak and NJ TRANSIT while the North River Tunnel is being rehabilitated. To do this, the Build Alternative must connect to the NEC and the existing tracks at PSNY, respectively:

- On the west, the Build Alternative must connect to the NEC in New Jersey in a way that allows operational flexibility for trains moving between the NEC and the new tunnel. Therefore, to provide a new route close to the NEC that maximizes the use of existing infrastructure, maintains flexible and redundant NEC rail operations for Amtrak and NJ TRANSIT, and minimizes the potential for environmental and community impact associated with new right-of-way, the Build Alternative's two new tracks should be immediately adjacent to the existing NEC, using existing Amtrak right-of-way where possible, and connect to the NEC as close as possible to the tunnel portal while providing switches between tracks for operational flexibility. The new tunnel must be south of the existing North River Tunnel to connect to PSNY (as described below). New approach tracks to the tunnel on the south side of the NEC in New Jersey would avoid the need for tunneling beneath or flying over the NEC to connect to the tunnel, and therefore would have fewer potential environmental impacts than new approach tracks on the north.
- On the east, the Build Alternative must connect to the array of approach tracks at A Yard that lead into PSNY, which provide access to PSNY Station Tracks 1 through 18. Connecting to these tracks allows trains to reach existing PSNY platforms and is essential to maintaining the NEC's current capacity and functionality. This connection can only be made at the southwestern end of the PSNY approach tracks because areas farther north are occupied by the existing tracks from the North River Tunnel, Amtrak's Empire Line (which heads north to Albany), and tracks connecting to the West Side Yard. The connection point on the southern end of the approach tracks would make use of the Hudson Yards Right-of-Way Preservation Project being constructed by Amtrak underneath the West Side Yard. The Hudson Yards Right-of-Way Preservation Project preserves a rail right-of-way beneath the extensive overbuild project that is planned to be constructed on a platform above the rail complex (discussed below in Section 2.5.2.1.4). Any other connection point would conflict not only with the existing rail infrastructure but also with the foundations and supports for this platform.

Given these constraints, the alignment for the Build Alternative's new tunnel would be as follows:

- **New Jersey Surface Alignment:** The Build Alternative's two new tracks would be immediately adjacent and to the south of the existing NEC, using existing Amtrak right-of-way where possible and providing switches between existing and new tracks for operational flexibility.
- **Alignment for Tunnel in New Jersey and Beneath Hudson River:** From the portal in the western face of the Palisades, the Build Alternative would include a new tunnel with two tracks in two separate tubes extending beneath the Palisades rock formation and beneath the adjacent waterfront area east of the Palisades, continuing beneath the Hudson River to Manhattan. East of the Palisades, the Build Alternative would have a vertical ventilation shaft connecting to the tunnel and associated fan plant building located above or near the tunnel to provide fresh air to the tunnel, exhaust smoke during emergencies, and provide emergency egress from and access to the tunnel. Several different alignment options were evaluated for this portion of the Build Alternative, as discussed below.
- **Manhattan Tunnel Alignment:** From the Manhattan bulkhead to the PSNY approach tracks at A Yard in New York, the Build Alternative would consist of a new tunnel with two tracks that would extend from the waterfront to join the Hudson Yards Right-of-Way Preservation Project. The Build Alternative would then continue through the right-of-way preservation

project, to connect to the existing approach tracks at A Yard that serve PSNY. This portion of the alignment would include a vertical ventilation shaft connecting to the tunnel and an associated fan plant building located above or near the tunnel to provide fresh air to the tunnel and to exhaust smoke during emergencies. The only available site for such a ventilation shaft is on the Manhattan block between Eleventh and Twelfth Avenues and West 29th and 30th Streets (also known as Block 675), since the area west of that block is parkland and the area east of that block is currently either being developed with a large-scale development or is already developed.

2.3.2.2 ALIGNMENT OPTIONS FOR TUNNEL BETWEEN NEW JERSEY PORTAL AND MANHATTAN BULKHEAD

Multiple alignment options are possible for the Build Alternative's new tunnel between its portal at the western slope of the Palisades and the Manhattan shoreline. To identify the routing that best meets the Project goals and objectives, four conceptual alignment options were identified based on potential locations where a vertical ventilation shaft and associated fan plant could be sited in New Jersey. The vertical ventilation shaft must be directly connected to the tunnel at a point east of the Palisades, which is an area where few undeveloped properties exist. The location of the ventilation shaft therefore determines the tunnel alignment between the tunnel portal and the waterfront area east of the Palisades.[7] The ventilation shaft site would also be used as a construction staging site. **Figure 2-2** illustrates the four alignment options considered. As shown in the figure, these options were as follows:

- **Alignment Option 1:** Tunnel alignment close to the existing North River Tunnel, with a ventilation shaft site on a portion of an office building's parking lot near the Lincoln Tunnel Helix in Weehawken, New Jersey.
- **Alignment Option 2:** Tunnel alignment south of Option 1, with a shaft site on a property occupied by a commercial office building north of 19th Street near JFK Boulevard East in Weehawken.
- **Alignment Option 3:** Tunnel alignment south of Option 2, with a shaft site south of 19th Street near the Hudson-Bergen Light Rail (HBLR) in Weehawken. Two potential shaft sites were identified for this alignment: one on a previously vacant site on Harbor Boulevard south of 19th Street, which is now occupied by a large new residential project, and the other on the property occupied by Dykes Lumber Company, south of 19th Street between the HBLR right-of-way and Park Avenue.
- **Alignment Option 4:** Tunnel alignment south of Option 3, with a shaft site south of 18th Street in Hoboken, New Jersey. This option would follow the same horizontal alignment in New Jersey identified in the ARC Project's DEIS and SDEIS/FEIS Build Alternatives, and would use the same shaft site in Hoboken as the ARC Build Alternatives.

The alignment options were evaluated and compared in terms of how well they meet the Project goals and related objectives (detailed in Chapter 1, "Purpose and Need"):

- Goal 1: Improve service reliability and upgrade existing tunnel infrastructure in a cost-effective manner.
- Goal 2: Maintain uninterrupted existing NEC service, capacity, and functionality by ensuring North River Tunnel rehabilitation occurs as soon as possible.

[7] While the Project's ventilation shafts must directly connect to the tunnel, and the Project's fan plants are also best placed directly above the tunnel, the Project's fan plants can be offset from the tunnel if necessary, in which case they would be connected to the tunnel by a plenum that carries air between the ventilation shaft and the fan plant.

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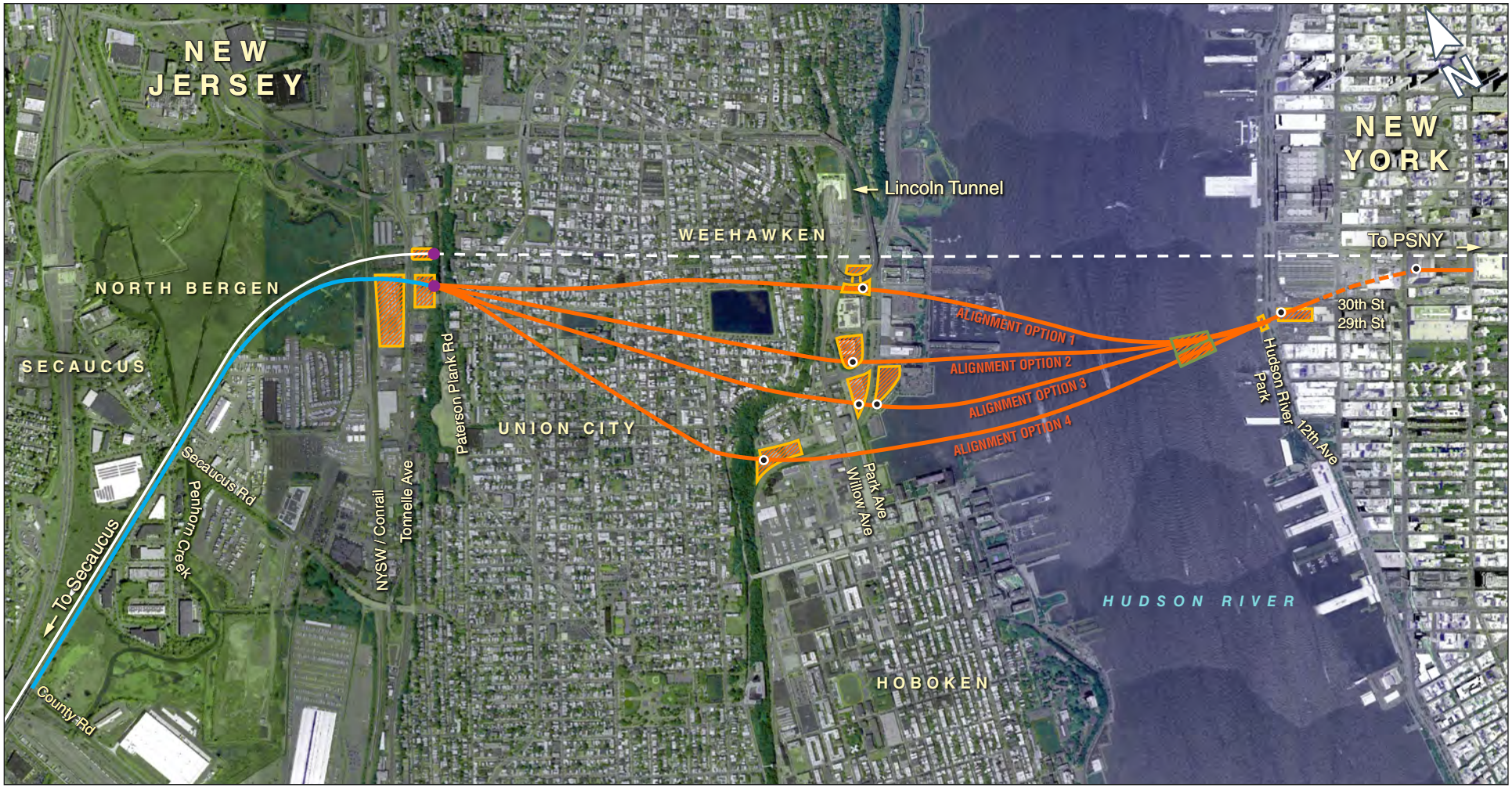

Existing Northeast Corridor

North River Tunnel to be Rehabilitated

Hudson Yards Right-of-Way Preservation

Tunnel Alignment Option

Tunnel Portal

New Surface Tracks

Construction Staging Area

In-Water Construction

New Ventilation Facilities

HUDSON TUNNEL PROJECT

Tunnel Alignment Options

Figure 2-2

- Goal 3: Strengthen the NEC's resiliency to provide reliable service across the Hudson River crossing, facilitating long-term infrastructure maintenance and enhancing operational flexibility.
- Goal 4: Do not preclude future trans-Hudson rail capacity expansion projects.
- Goal 5: Minimize impacts on the natural and built environment.

The refined screening evaluation concluded that Option 4 best meets the Project goals and objectives and is the preferred alignment option. Option 4 offers the following advantages over the other alignment options:

- Least potential for delays to the Project schedule, because of the pre-construction risk related to property acquisition, investigation, and remediation already conducted for the ventilation shaft site as part of the ARC Project;
- Minimal impacts to existing transit and other transportation services; and
- Least impact related to displacement of active uses (e.g., residential, business, and future residential), since NJ TRANSIT has already acquired the properties needed for the New Jersey shaft site and staging areas.

While Alignment Option 4 would have a slightly longer tunnel than the other options, this was not found to result in negative impacts that outweighed this option's advantages. Alignment Option 4 would have a greater construction cost for tunneling than Alignment Options 1 through 3 because of the additional length, but if construction is delayed for Alignment Options 1 through 3 because of their greater pre-construction risk, the cost difference would be minimized and might be eliminated after accounting for cost increases that occur from inflation. Similarly, while the tunneling for Alignment Option 4 could take slightly longer than for the other options (2.5 months longer than the shortest alignment option, Alignment Option 1), this would be a small difference relative to the total schedule of seven years, and could be eliminated with any delay in Alignment Options 1 through 3. Finally, the slightly longer tunnel length for Alignment Option 4 would not meaningfully increase travel time for trains in the tunnel, especially once operating conditions at and near PSNY are considered. While trains operating at the maximum design speed through the tunnel would have different potential total travel times, in reality, controlling signals at Tenth Avenue near PSNY would result in a uniform speed step-down for eastbound trains approaching PSNY. This would reduce the difference between different travel times farther west (e.g., from the Tonnelle Avenue portal to the middle of the Hudson River) as trains are slowed to reach a common location at a common point in time, based on PSNY dispatching and operational issues. In reality, therefore, the four alignment options would likely have little or no difference in travel times between Secaucus Junction Station and PSNY.

Each of the other alignment options (Options 1 through 3) would be feasible, but was found to have one or more substantial disadvantages relative to Option 4:

- Alignment Option 1 would have a construction staging site within the Lincoln Tunnel Helix (the curving approach ramp to the Lincoln Tunnel), which would require displacement of NJ TRANSIT's existing Weehawken bus parking and staging site currently located there. The bus parking facility is used to store approximately 160 buses at a location close to the Lincoln Tunnel so that they can reliably reach the Port Authority Bus Terminal for the evening commute. Displacement of this bus parking area would result in substantial negative impacts on NJ TRANSIT's trans-Hudson bus operation serving the Port Authority Bus Terminal and providing service to thousands of commuters. Option 1's shaft site and staging area would also have the potential for major conflicts with future Lincoln Tunnel Helix reconstruction being planned by the PANYNJ. In addition, Option 1 may introduce delays to the Project schedule associated with the need to acquire new property for the shaft site and

staging area and to conduct other pre-construction activity. For these reasons, Option 1 was eliminated from further consideration.

- Alignment Option 2 would require the acquisition and demolition of an existing, occupied, multi-story office building for its shaft site and staging area, an adverse impact that could be avoided by Option 4. In addition, Alignment Option 2 may introduce delays to the Project schedule associated with the need to acquire new property for the shaft site and staging area and to conduct other pre-construction activity. Alignment Option 2 has no substantial advantages over Option 4 and would not reduce potential environmental impacts relative to Option 4. For these reasons, Option 2 was eliminated from further consideration.
- Alignment Option 3 was eliminated from further consideration because using the shaft site along Harbor Boulevard would preclude the development of at least a portion of a major planned residential development currently under construction at 800 Harbor Boulevard (a residential project that is now complete), an adverse impact that could be avoided by Option 4. In addition, at the time that the alternatives evaluation was conducted, acquisition of the alternative staging area would have required displacement of the active commercial use at Dykes Lumber Company. Since the alternatives evaluation was conducted, Dykes Lumber Company has put its property up for sale, but the business remains in operation at the time of publication. Even though the Dykes Lumber Company property is now for sale and therefore development of Option 3 with the alternative shaft site may not have to result in displacement of that business, Alignment Option 3 would still have the potential to introduce delays to the Project schedule associated with the need to acquire new property for the shaft site and staging area and to conduct other pre-construction activity. Option 3 has no substantial advantages over Option 4. Therefore, Alignment Option 3 was not considered further.

FRA and NJ TRANSIT thus progressed Alignment Option 4 as the tunnel alignment for the Build Alternative. That alternative, including the tunnel alignment identified as a result of the screening process, is the Preferred Alternative for evaluation in the EIS.

2.3.3 ADDITIONAL ALTERNATIVES CONSIDERED AFTER COMPLETION OF THE DEIS

Following completion of the DEIS for the Hudson Tunnel Project, FRA and NJ TRANSIT conducted two additional analyses of potential alternatives: an evaluation of alternative construction methods in New Jersey and an evaluation of alternative approaches for rehabilitation of the North River Tunnel.

2.3.3.1 ALTERNATIVE CONSTRUCTION METHODS

In response to comments from the public during the comment period on the DEIS, FRA and NJ TRANSIT, working with the other Project Partners, conducted an evaluation of construction methods to reduce truck volumes in Weehawken in order to lessen construction impacts to the local residential community near the Hoboken staging area. FRA, NJ TRANSIT, and the other Project Partners evaluated a wide range of potential methods to remove excavated materials from the river tunnel with the goal of reducing the number of trucks on local streets in Weehawken. This included the potential use of different truck routes, barging excavated materials from the Weehawken waterfront, and removing excavated materials by freight trains operating on the HBLR right-of-way. This evaluation is described in Chapter 3, "Construction Methods and Activities," Section 3.3.4.6, and is presented in full in **Appendix 3-1**, "Options for Spoils Removal and Materials Deliveries at the Hoboken Staging Area."

As a result of the post-DEIS evaluation of alternative construction methods in New Jersey, the proposed approach for construction of the Preferred Alternative is now revised to reduce the

impacts of Project construction on local communities near the construction sites. Chapter 3, "Construction Methods and Activities," describes the revised approach in Section 3.3.3.

2.3.3.2 ALTERNATIVE APPROACHES FOR REHABILITATION OF THE NORTH RIVER TUNNEL

After FRA issued the DEIS in 2017, information became available about other rehabilitation approaches that might allow for rehabilitation of the North River Tunnel while the tunnel remains in service. These alternative approaches include the methodology that MTA used in 2019 and 2020 to conduct an in-service rehabilitation of a tunnel on the L subway line in New York City and a methodology for an in-service rehabilitation for the North River Tunnel proposed in a 2020 review prepared for the Gateway Program Development Corporation by London Bridge Associates (LBA). FRA, NJ TRANSIT in its role as an operator of rail service in the tunnel, and Amtrak in its role as an operator of rail service in the tunnel and as lead for design of the tunnel rehabilitation, evaluated these potential approaches for the North River Tunnel rehabilitation to determine whether they met the alternatives development criteria.

2.3.3.2.1 Alternative Approach to Reconstruction: New York City Subway Canarsie Tunnel Approach

A number of the New York City subway tunnels also sustained damage during Superstorm Sandy in 2012. Among those, the L subway line's crossing beneath the East River, known as the Canarsie Tunnel, required substantial rehabilitation. MTA conducted the rehabilitation work during extended nighttime and weekend work periods, so that full subway service could remain in operation on weekdays between 5 AM and 8 PM. While rehabilitation work was under way overnight (from 10 PM to 5 AM) and on weekends (from 10 PM on Fridays to 5 AM on Mondays), one tube of the tunnel was closed in full and the other remained open.

Rather than replace the communications cables and low-voltage power cables (including negative cables, positive cables, battery cables, control cables, and tunnel shell protection cables) housed within the bench walls of the two tubes of the Canarsie Tunnel, MTA abandoned the cables in place and suspended new low-voltage, fire-rated cables from the sides of the tunnel walls (a system referred to as "racking" the cables).

The North River Tunnel's bench walls must be replaced rather than retained, to facilitate repair of the damaged tunnel liner behind the bench walls and to create a walkway in the tunnel that provides adequate emergency egress from the tunnel and access for emergency personnel and maintenance workers. As described in Chapter 1, "Purpose and Need," chlorides from seawater remain in the tunnel's concrete liner, causing ongoing damage that must be addressed. The areas of the tunnel liner behind the bench walls and beneath the tracks and ballast are currently not accessible, because of their location behind those permanent features. While the existing Canarsie Tunnel bench walls were at the height of a subway car's floor and therefore allowed for safe access, the existing bench walls in the North River Tunnel are 18 inches higher than the height of the floors for Amtrak and NJ TRANSIT trains that operate in the tunnel and therefore are too high to meet modern safety standards for egress and access. New bench walls (or other form of walkway) are needed at a lower height that is level with the floor of the Amtrak and NJ TRANSIT trains that operate in the tunnel.

The North River Tunnel includes more cables and conduits than the Canarsie Tunnel, including high-voltage feeder cables that must be protected from fire and impact, and therefore racking all the cables in the North River Tunnel, as was done for the Canarsie Tunnel, would not be appropriate. Whereas the Canarsie Tunnel's bench walls housed only low-voltage cables, the North River Tunnel's bench walls house high-voltage feeder cables that provide traction power (i.e., power for trains) to the PSNY complex, including approach tracks and platform tracks, high-

voltage facilities power transmission cables, signal power cables, and relatively smaller low-voltage facilities power cables, including cables for pumps and lighting, and critical communications cables for Amtrak and third parties.

To protect the high-voltage feeder cables in the North River Tunnel from fire, impact, and blast, they must be enclosed in a fire-rated and impact- and blast-proof enclosure. If such an enclosure were hung from the tunnel walls, the enclosure would be far heavier (20 times heavier) than the utilities currently mounted on the tunnel wall and would require driving thousands of additional support bolts into the full length of the century-old tunnel liner. This would add unnecessary stress, penetrations, and corrodible metals to the tunnel liner, introducing significant safety risks that are unacceptable since there is a proven alternative that is safer and more robust, with fewer impacts to the concrete liner and tangible protective and structural benefits.

Furthermore, the Canarsie Tunnel rehabilitation did not involve full replacement of the trackbed, since that tunnel already had a direct fixation track system. The North River Tunnel rehabilitation includes full replacement of its antiquated ballasted trackbed with a modern direct fixation track system to address ongoing drainage issues created by the ballast.

2.3.3.2.2 Alternative Approach to Reconstruction: London Bridge Associates Recommendations

In its November 23, 2020 report, LBA confirmed that all proposed elements of Amtrak's proposed design for the rehabilitation are important and should be completed as soon as possible. Specifically, the report confirmed that the rehabilitation project should include, among other things, repairing the tunnel lining and sealing leaks; replacing mechanical and electrical services in the tunnel with new and improved systems; replacing the high-voltage cables; demolishing and replacing the bench walls; replacing the overhead catenary system; replacing the signal system; replacing the ballasted trackbed with a direct fixation system with superior drainage; and lowering and realigning of the track to provide better electrical clearances for the overhead catenary system.

While LBA confirmed that all components included in Amtrak's rehabilitation design should be included, LBA recommended a reorganized approach to rehabilitation with a number of changes to the methodology for specific elements of the rehabilitation program, to expedite those items or allow them to contribute to an "in-service" rehabilitation concept.

Amtrak and NJ TRANSIT have reviewed the conceptual rehabilitation approach that LBA proposed in its November 2020 report and have concluded that while a number of the specific techniques LBA recommended may be applicable for the North River Tunnel rehabilitation, the overall approach of expediting the rehabilitation project by conducting it one tube at a time on weeknights and weekends while keeping the other tube of the tunnel in service cannot be reliably conducted without material delays to commuter and intercity rail service, and thus would not meet the purpose and need of the Project.

LBA also made several assumptions that differed from what Amtrak is considering for the North River Tunnel rehabilitation, including, for example, LBA's assumption that the 85 to 100 percent of the available track outages in the North River Tunnel would be dedicated to the rehabilitation work in the North River Tunnel. LBA stated that routine ongoing maintenance should be integrated with the rehabilitation operations, both in terms of outages and locations. Based on past experience with the need for track outages across the PSNY complex, Amtrak has concluded that North River Tunnel rehabilitation work cannot always be coordinated effectively with other repair and maintenance work in PSNY. Given the ongoing need for construction in the PSNY complex in addition to the North River Tunnel rehabilitation, it is not reasonable to assume that this level of track outages can be dedicated to the North River Tunnel rehabilitation alone.

Because the existing two-track North River Tunnel operated at its full peak-period capacity prior to the COVID-19 global pandemic, it cannot provide redundancy for reliable train operations during disruptions or maintenance. Any service disruption therefore results in major passenger delays and substantial reductions to overall system flexibility, reliability and on-time performance. Since 2012, the need to perform increased maintenance to address damage caused by Superstorm Sandy has required occasional weeknight and weekend tunnel outages, which most often do not require a reduction in train service. When weeknight work occurs, which is on an as-needed but fairly regular basis, it is conducted with track outages from 11 PM until 5 AM the next morning. This six-hour window results in an effective four-hour work period, after deducting an hour at the beginning and end of the period for set up and clean-up and inspection prior to returning the tracks to service. During the four-hour work period, Amtrak conducts typical maintenance and repair activities. Because of the frequent need for weekend access to support repairs and maintenance in one tube of the North River Tunnel and other repairs in the PSNY complex, Amtrak and NJ TRANSIT implemented a regular weekend train schedule with reduced service more than five years ago.

Amtrak and NJ TRANSIT have determined that the approach LBA recommended in its 2020 report to sequencing and organizing the rehabilitation activities is too complex and risky to be reliably implemented repeatedly, without unplanned disruptions to weekday morning train service, as described below. The concurrent cutting, reconstruction, splicing, and commissioning of multiple systems introduces multiplicative risk components, since any one of the various work activities could cause a delay in restoring service. For each system, unforeseen complications have the potential to occur, such as encountering unexpected leaks and cracks, old vault chambers, pile insert caps, under-track conduit paths, drainage interface paths, or other obstructions that must be addressed in a unique manner. In addition, having multiple work groups handling different systems in a single tunnel and competing for single-path material delivery, power and ventilation requirements will further complicate the construction. An ongoing work program of this nature, occurring on weeknights and weekends over several years with multiple simultaneous work activities, would likely have a much higher incidence of unexpected problems than occur today during regular tunnel maintenance.

As described in the LBA report, over the weekend construction periods, comprehensive rehabilitation would at times involve up to nine separate operations in one tube of the North River Tunnel simultaneously. Each of these operations would have to set up, construct some piece of a system, reconnect that new work to existing features, test each piece as well as all the new work as a whole, and return the tube to rush hour service safely and without speed restrictions. For example, in LBA's concept for phased installation of the new trackbed, a section of the existing track and trackbed would have to be demolished, rebuilt, and converted to direct fixation track with a safe transition between the existing ballasted track system and new direct fixation track during a 55-hour weekend construction period.

In another example, LBA's plan to replace the bench walls in the tunnel in a phased manner would require:

- Relocating all in-bench utilities to other locations on the other side of the tunnel, other bench wall or other tube (however, Amtrak notes that almost all tunnel walls and benches are fully subscribed and space is either unavailable, would impinge on existing egress, or would create potential hazards for the public if emergency evacuation is required).
- Phased demolition of the bench wall in segments
- Building back a new, lower bench segment of desired form

Conducting an "in-service" rehabilitation on one tube of the tunnel while train service continues in the other tube introduces the risk of major disruption if an unplanned outage occurs in the

open tube of the tunnel. Given the condition of both tubes, this type of unplanned outage occurs regularly. Without an alternate tunnel route (as proposed with the Preferred Alternative), if an unplanned outage occurred in the remaining open tube of the tunnel while the other tube is closed, this would completely shut down service on the NEC and shut down or severely curtail rail operations throughout New Jersey until either the second outage were resolved or the rehabilitation work could be demobilized and service restored. Passengers would have great difficulty finding alternative routes, since all trans-Hudson transportation routes and services operate at or near capacity during peak travel hours. Suspension of service on the NEC has been estimated by the Northeast Corridor Commission to cost the U.S. economy some $100 million per day. The North River Tunnel is a single point of failure for this important system and maintaining service through it is essential.

2.3.3.2.3 Conclusion

Based on the specific engineering requirements for rehabilitating the North River Tunnel, the tunnel's heavy train volumes throughout the day, and the lack of alternative rail access from west of the Hudson River, these in-service approaches to rehabilitation cannot be reliably conducted without material delays to commuter and intercity rail service. Because the existing two-track North River Tunnel is operating at its full peak-hour capacity in the morning and evening peak periods, it does not provide redundancy for reliable train operations during disruptions or maintenance. Any service disruption therefore results in major passenger delays and substantial reductions to overall system flexibility, reliability, and on-time performance. Because of the importance of the North River Tunnel to essential commuter and intercity rail service between New Jersey and New York City, rehabilitation of the existing North River Tunnel needs to be accomplished without material delays to commuter and intercity rail service. Therefore, these in-service rehabilitation approaches would not meet the purpose and need of the Project.

Acknowledging the importance of conducting rehabilitation work as soon as possible without impacting service, as LBA highlighted in its report, Amtrak has been advancing critical repair work in the tunnel through its North River Tunnel Interim Reliability Improvements Program, a program to address the root causes of delay and other impacts to service to improve reliability and safety in the North River Tunnel in the near term (for more information, see Section 2.4 below). In addition, Amtrak and NJ TRANSIT are reviewing LBA recommendations to determine which innovative and achievable suggestions, such as additional surveys and testing and the use of mechanical measures to enhance productivity, can be incorporated into the design for the North River Tunnel rehabilitation, with the goal of shortening the duration of a long-term tunnel closure and improving the customer experience sooner.

2.4 NO ACTION ALTERNATIVE

National Environmental Policy Act (NEPA) regulations require examination of a No Action Alternative, which is an alternative to examine the conditions that would exist if the proposed action were not implemented. The No Action Alternative serves as a baseline against which the potential benefits and impacts of the Preferred Alternative can be compared.

For the Hudson Tunnel Project, no new passenger rail tunnel across the Hudson River is included in the No Action Alternative and therefore no full rehabilitation of the North River Tunnel is included. The No Action Alternative includes those measures that are necessary to keep the existing North River Tunnel in service and provide continued maintenance as necessary to address ongoing deterioration and maintain service. The No Action Alternative does not satisfy the purpose and need for the Project because it does not repair the deteriorating North River

Tunnel, and does not strengthen the NEC's resiliency to support reliable passenger rail service by providing redundant capability under the Hudson River.

As part of the analysis of the No Action Alternative, this EIS also considers other, independent projects that will be implemented or are being planned by others and appear likely to be implemented by the Project's analysis year of 2033. Those projects collectively form the future affected environment in which the No Action Alternative would occur and are described in Chapter 4, "Analysis Framework."

In the No Action Alternative, Amtrak will continue to maintain the North River Tunnel. In 2020, Amtrak began the North River Tunnel Interim Reliability Improvements Program to accelerate immediate maintenance and repair in the tunnel prior to its full rehabilitation. Through that program, Amtrak is examining options for a variety of repairs and improvements to the North River Tunnel with the goal of improving safety and reliability for the public over the next decade in advance of comprehensive rehabilitation. Measures that Amtrak identifies for implementation will advance into preliminary engineering, followed by construction beginning in 2022. Concepts that do not require advanced design will commence sooner.

The measures that Amtrak has identified as priorities include leak mitigation for water infiltrating the tunnel and affecting systems, which is contributing to signal failures and deterioration of metal components and cables; drainage and track improvements to address deterioration and geometry issues; implementation of an enhanced inspection and asset management program that will identify problems more quickly; detailed signal system investigations with targeted equipment replacement; stray current monitoring and mitigation; and other proactive steps in advance of problems.

Amtrak expects that targeted interventions developed through this program can temporarily mitigate many of the maintenance issues in the North River Tunnel that result in train delays, but they cannot deliver the comprehensive rehabilitation of the North River Tunnel contemplated as part of the Hudson Tunnel Project and necessary for the long-term preservation and safe use of the tunnel. Based on Amtrak's evaluation, Amtrak states that the improvements that they will implement as part of the North River Tunnel Interim Reliability Improvements Program will substantially improve rail operations through the tunnel in the near term, but will not eliminate the need for a complete rehabilitation of the North River Tunnel in the long term to address safety concerns and the damage and ongoing deterioration caused by Superstorm Sandy. Despite the ongoing maintenance that will continue in the No Action Alternative, damage to the North River Tunnel caused by the storm will continue to degrade systems in the tunnel. This deterioration combined with the tunnel's age and intensity of use will likely lead to increasing instability of rail operations in the tunnel, and may lead to its eventual closure before the analysis year of this Project is reached.

However, given the uncertainty about the timing and extent of any closure of the tunnel, for purposes of analysis in this EIS, FRA and NJ TRANSIT have assumed that the North River Tunnel would remain functional and in operation at least through the FEIS analysis year of 2033. Since the No Action Alternative is the baseline against which the impacts of the Preferred Alternative are compared in this EIS, this approach allows for a conservative and rigorous analysis of the impacts of the Preferred Alternative.

Without full rehabilitation of the North River Tunnel, the increased instability of rail operations and the potential for eventual full or partial closure of the tunnel would have wide-ranging impacts on travel in the region and on the region's social, economic, and environmental

conditions as a result. Based on existing ridership prior to the COVID-19 global health crisis,[8] a full closure of the North River Tunnel would disrupt up to 20,900 daily weekday Amtrak passenger trips (one-way rides) and up to 189,000 daily weekday NJ TRANSIT passenger trips, on approximately 500 trains per day, as a worst-case scenario. Even if only one tube of the North River Tunnel closes, this would disrupt up to 75 percent of the train service through the tunnel. Because all trans-Hudson transportation routes and services are operating at or near capacity during peak travel hours (prior to COVID-19), public transportation services paralleling the North River Tunnel (PATH trains, commuter buses, and ferries) would experience extreme overcrowding and delays and many passengers might elect not to make the trip or to travel via automobile on the region's congested roadway system. Such a shift from train to auto travel would exacerbate already congested conditions on the Hudson River crossings and major roads on both sides of the river and in the region. The Regional Plan Association's "Fourth Regional Plan" documents these capacity constraints of the trans-Hudson transit services and highlights the inability of these services to absorb substantial numbers of NEC commuters.[9]

2.5 PREFERRED ALTERNATIVE

The Preferred Alternative for the Project would consist of a new two-track Hudson River Tunnel, parallel to the North River Tunnel and extending from the NEC in Secaucus, New Jersey, beneath the Palisades (North Bergen and Union City) and the Hoboken waterfront area, and beneath the Hudson River to connect to the tracks in A Yard at PSNY. New ventilation shafts and associated fan plants would be located above the tunnel in New Jersey and New York for regular and emergency ventilation and emergency access. The western terminus of the new tunnel and related tracks and infrastructure would be east of County Road in Secaucus, New Jersey (just east of Secaucus Junction Station), and the eastern terminus would be at approximately Ninth Avenue in Manhattan, New York. This alignment would be about 4.5 miles long. No changes east of Ninth Avenue, and no changes to PSNY platforms or platform tracks, are proposed as part of the Preferred Alternative.

The Preferred Alternative would also include a rehabilitated North River Tunnel, so that upon completion of the Project, the NEC would have four tracks (two in the new Hudson River Tunnel and two in the North River Tunnel) between New Jersey and New York under the Hudson River, which would provide operational flexibility and redundancy for Amtrak and NJ TRANSIT rail operations.

Figure 2-3 illustrates the Preferred Alternative. As shown in the figure and described in this chapter, major project components of the Preferred Alternative would include:

- Two new surface tracks parallel to the south side of the NEC beginning at a realigned Allied Interlocking[10] in Secaucus, New Jersey just east of NJ TRANSIT's Secaucus Junction Station. These tracks would be accessible for maintenance via a new access road.
- A new tunnel with two tracks in two separate tubes beneath the Palisades and the Hoboken/ Weehawken waterfront area east of the Palisades, continuing beneath the Hudson River to

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[8] Reflecting conditions prior to March 2020, when the COVID-19 global health crisis resulted in substantial decreases in the number of people using rail. This EIS does not assess the long-term implications of the COVID-19 global health crisis, since any evaluation at this time would be speculative. This EIS assumes that in the long-term, commuting patterns will recover and return to their previous levels.

[9] https://rpa.org/work/reports/crossing-the-hudson.

[10] An interlocking is a system of switches and signals that allows trains to make connections from one track to another.

Manhattan. In New Jersey, the tunnel would begin at a portal in the western slope of the Palisades, just east of Tonnelle Avenue (U.S. Routes 1 and 9). The two new tracks would continue through the Manhattan bulkhead, beneath Hudson River Park and Twelfth Avenue to meet the underground Hudson Yards Right-of-Way Preservation Project being developed by Amtrak beneath the Hudson Yards overbuild project at the Western and Eastern Rail Yards in Manhattan.

- Two new tracks and associated rail systems to be added by the Project to the Hudson Yards Right-of-Way Preservation Project.
- An extension of the tunnel past the Hudson Yards Right-of-Way Preservation Project beneath Tenth Avenue to a tunnel portal east of Tenth Avenue, within the complex of tracks located beneath the existing building that spans the tracks on the east side of Tenth Avenue (450 West 33rd Street). The new tunnel portal would be near the tunnel portals for Amtrak's Empire Line and for the North River Tunnel.
- Track connections east of Tenth Avenue to the existing approach tracks at A Yard into PSNY.
- A ventilation shaft and associated fan plant building in Hoboken, New Jersey.
- A ventilation shaft and associated fan plant building near Twelfth Avenue between West 29th and 30th Streets (Block 675) in Manhattan.
- A fan plant beneath the building at 450 West 33rd Street east of Tenth Avenue between West 31st and 33rd Streets, which sits above the rail right-of-way.
- Rehabilitation of both tubes of the existing North River Tunnel.

The permanent features of the Preferred Alternative are described in more detail below; construction activities and corresponding temporary features associated with building the Preferred Alternative are described in Chapter 3, "Construction Methods and Activities."

2.5.1 SURFACE ALIGNMENT IN NEW JERSEY

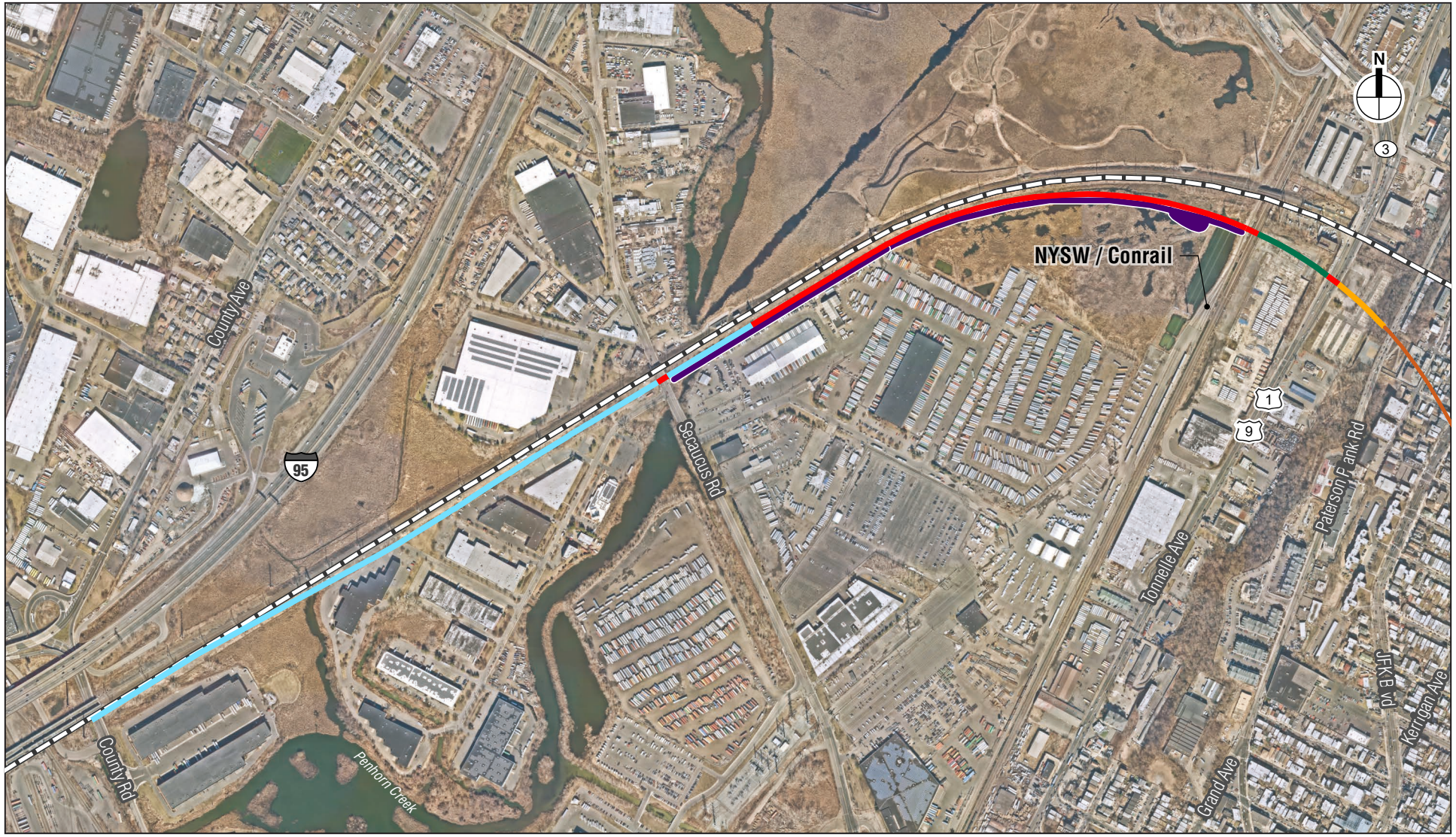
2.5.1.1 ALIGNMENT

The western portion of the Preferred Alternative, in Secaucus and North Bergen, New Jersey, would provide the connection between the existing tracks of the NEC and the new approach tracks leading to and from the tunnel. This portion of the Project is shown in **Figure 2-4**.

Starting from the west, elements of the Preferred Alternative would include the reconstruction and modification of the NEC's Allied and Bergen Interlockings, just east of Secaucus Junction Station, to tie the Project into the existing NEC tracks. An interlocking is a system of signals and switches that connects multiple tracks, so that trains can move between the tracks. In this area, the NEC is on an embankment approximately 20 to 30 feet above the surrounding properties. With the Preferred Alternative, the embankment would be widened to the south to accommodate two new tracks, which would diverge from the existing alignment approximately 2,000 feet east of Secaucus Road. The work at Allied Interlocking would begin at approximately County Road (just east of Secaucus Junction Station) and continue to the new tunnel, which would begin at the western face of the Palisades (see Section 2.5.2 below).

As shown in **Figure 2-4**, the widened embankment would be supported by a retaining wall along its southern edge where the tracks would be close to adjacent businesses, extending from County Road to east of Secaucus Road. Use of a retaining wall would reduce the land area needed for the new tracks. The new surface track segment of the Preferred Alternative would cross Secaucus Road on a rail bridge adjacent to the existing NEC.

5.3.21



Existing Northeast Corridor
New Tunnel
New Surface Road
New Surface Tracks (Retained Fill)
New Surface Tracks (Viaduct)
New Surface Tracks (Embankment)
New Surface Tracks (Retained Cut)

0 1,000 FEET

HUDSON TUNNEL PROJECT

New Jersey Surface Alignment

Figure 2-4

East of the new right-of-way supported by the retaining wall, approximately 3,100 feet of the new alignment would be supported on a viaduct over undeveloped wetlands and would continue on a bridge over the freight rail right-of-way owned by Conrail and New York Susquehanna & Western Railway (NYSW). The bridge over the freight rail tracks would have two spans with a center support pier.

The segment of the new alignment between the freight rail right-of-way and Tonnelle Avenue would be on a sloped (unretained) embankment.

As shown in **Figure 2-4**, the Preferred Alternative would pass beneath Tonnelle Avenue, which would span the tracks on a new roadway overpass. The tracks would then continue in a cut to connect to the new tunnel portal on the east side of Tonnelle Avenue, which is approximately 600 feet south of the existing North River Tunnel portal.

2.5.1.2 ACCESS ROADS

Between County Road and Secaucus Road, the new, widened alignment would be accessible to maintenance workers and emergency personnel from the adjacent properties' parking areas. East of Secaucus Road, where easy access from existing roads or parking areas is not available, a new 20-foot-wide access road would run along the southern side of the new viaduct for approximately 3,700 linear feet (approximately 0.7 miles), until the Conrail-NYSW freight rail right-of-way (west of Tonnelle Avenue). To support two-way traffic, the access road would have a turnaround loop at its eastern terminus, just west of an area of open water wetland on the western side of the freight rail right-of-way; a narrower maintenance roadway would continue beyond this loop beneath the viaduct to the edge of the freight rail right-of-way.

2.5.1.3 TRACK

New surface track installed along the NEC would be ballasted track with concrete ties, and the rail would be continuous welded rail. Improvements would be made to Allied Interlocking to support integrated operation between the NEC and the new tunnel. The improvements would maintain passenger transfer capabilities at Secaucus Junction Station by providing the capability for NJ TRANSIT trains to stop at Secaucus Junction Station without delays to trains behind them. Eastbound trains headed to PSNY would continue through Allied Interlocking to either the North River Tunnel or the new Hudson River Tunnel, depending on the specific operating plan implemented in the future once the Preferred Alternative is in place.

2.5.1.4 DRAINAGE

In the western portion of the surface alignment in New Jersey, an approximately 2,400-foot-long drainage ditch that runs alongside the tracks between approximately Penhorn Creek's western branch and Secaucus Road would be relocated into a new 36-inch-diameter underground storm sewer to be located within the paved parking areas of adjacent properties to the south of the right-of-way.

As part of the widened railroad embankment for the NEC through the Meadowlands, culverts that currently cross beneath the existing embankment would be extended to continue beneath the widened embankment. These culverts would include the following:

- Penhorn Creek (west – between County Road and Secaucus Road): the culvert that carries Penhorn Creek beneath the embankment would be extended.
- Penhorn Creek (east – east of Secaucus Road): the twin culverts that carry Penhorn Creek beneath the embankment would be extended.

Where the existing twin culvert meets Penhorn Creek south of the NEC, an existing inoperable pump station and weir would be removed; a new weir would be installed at a different location

downstream of the twin culvert to maintain surface water elevations in the upstream portion of Penhorn Creek and associated wetlands.

At one location just east of Secaucus Road, a tributary to Penhorn Creek that runs in a drainage ditch along the south side of the embankment would be channelized in an open channel along the new railroad embankment wall. The new access road would pass over this tributary on a trestle with a grated surface to allow light to reach the creek below.

2.5.1.5 UTILITIES

During construction for the Preferred Alternative (discussed in Chapter 3, "Construction Methods and Activities"), the Project contractor would relocate utilities that are located within the alignment as necessary to facilitate construction. In the surface alignment portion, this would occur primarily at Secaucus Road, to accommodate the new rail bridge over that road, and at Tonnelle Avenue, where a new roadway overpass would be created.

2.5.2 HUDSON RIVER TUNNEL

The new Hudson River Tunnel would begin at a portal in the western slope of the Palisades, approximately 600 feet south of the North River Tunnel's portal in North Bergen, New Jersey. Like the North River Tunnel, the new tunnel would consist of two separate tubes. The tunnel alignment would be beneath the Palisades, the waterfront area of Hoboken, the Hudson River, and the waterfront area in Manhattan, and then would join existing below-grade rail infrastructure in Manhattan. From portal to portal, the tunnel would be approximately 2.8 miles long. **Figures 2-5 and 2-6** illustrate the overall alignment of the new tunnel.

2.5.2.1 ALIGNMENT

2.5.2.1.1 Palisades (New Jersey)

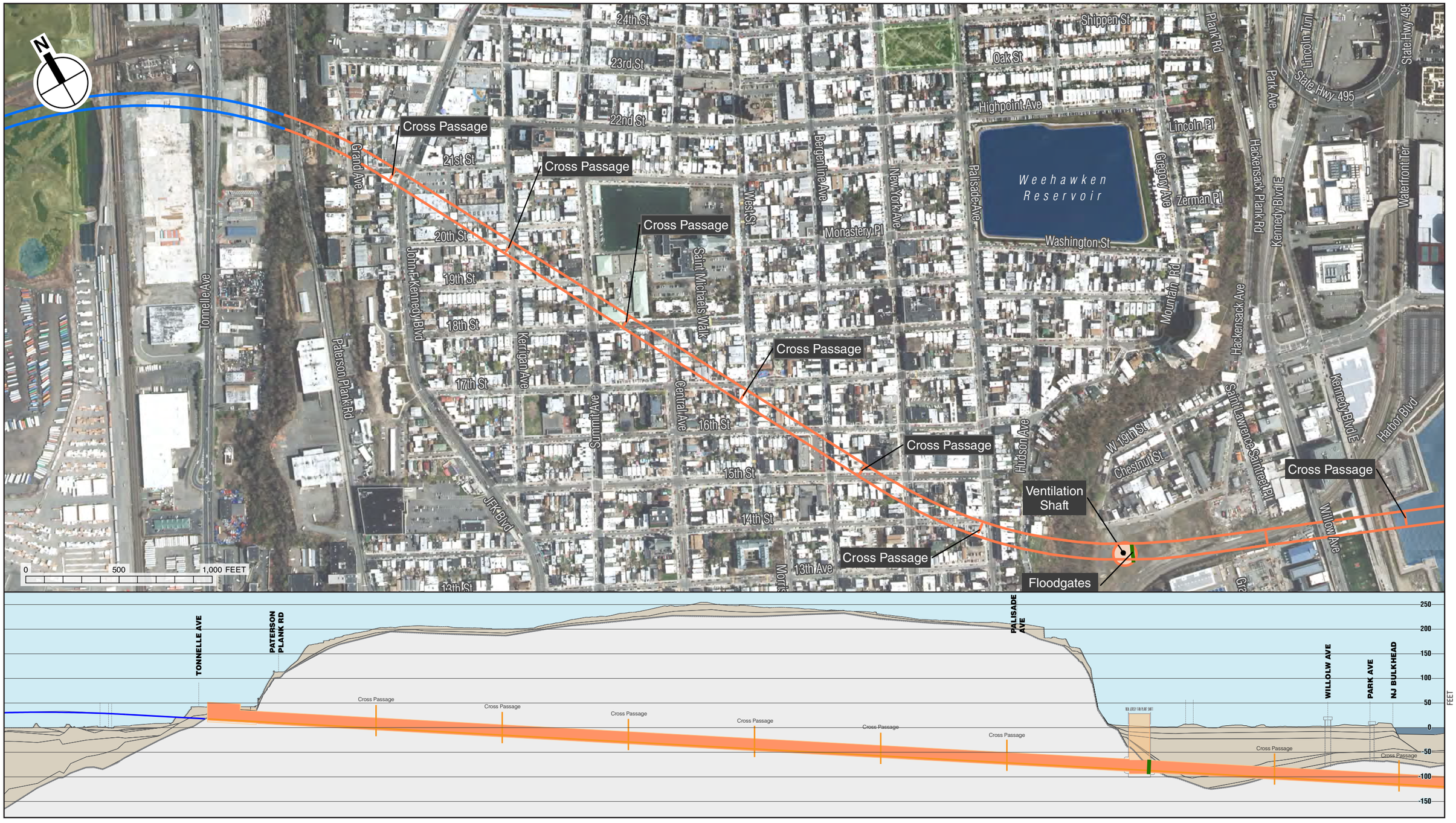
The tunnel would run through the hard rock of the Palisades landform beneath North Bergen and Union City, at a similar vertical elevation as the existing North River Tunnel, which is also located beneath the Palisades. Along the western face of the Palisades, as the grade rises sharply, the tunnel would enter the rock face (through the tunnel portal) and would descend gradually at a grade of approximately 1.9 percent. As shown in **Figure 2-5**, the top (i.e., crown) of the tunnel would be approximately 70 feet below the surface at Paterson Plank Road, 150 feet at Grand Avenue, 175 feet at John F. Kennedy Boulevard, 225 feet at Summit Avenue, 260 feet at Central Avenue, 275 feet at West Avenue and Bergenline Avenue, 250 feet at New York Avenue and Palisade Avenue and 180 feet at Manhattan Avenue.

2.5.2.1.2 East of the Palisades (New Jersey)

East of the Palisades, the tunnel would run beneath southern Weehawken and northern Hoboken, passing beneath the HBLR tracks, Willow Avenue, and Park Avenue, and beneath the Hudson River bulkhead. The tunnel would continue to descend gradually toward the east through this section. The top of the tunnel would be approximately 60 to 75 feet below the surface in Hoboken.

The Preferred Alternative includes a vertical shaft from the tunnel to the surface on a site just east of the Palisades in Hoboken (with small segments in Union City and Weehawken). The shaft would provide emergency access/egress to and from the tunnel and would serve as part of the tunnel ventilation system. A fan plant would be located above the shaft. More information on the tunnel ventilation system and this fan plant is provided in Section 2.5.2.6 below.

5.21.21



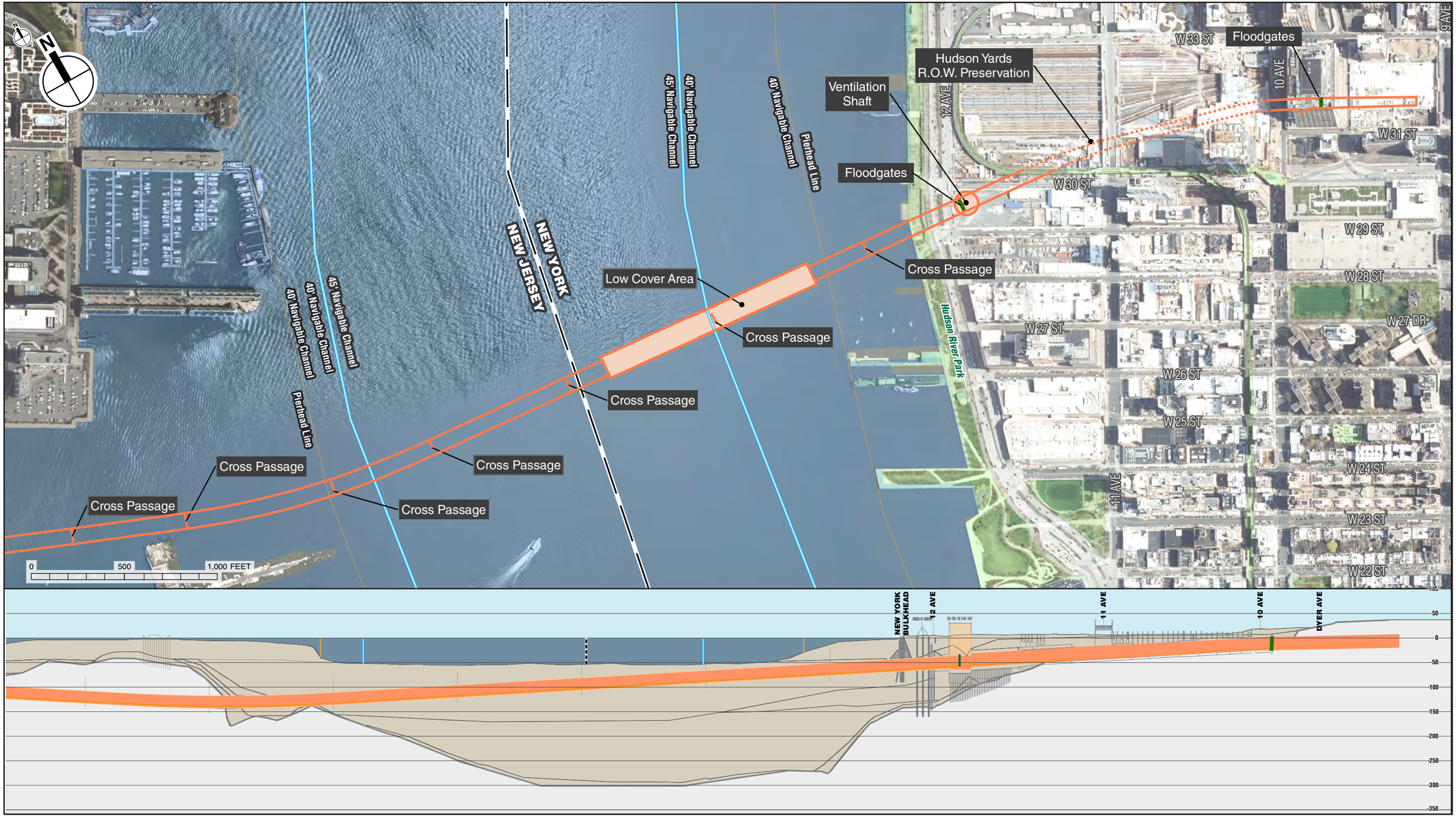
Surface Tracks *Tunnel* *Rock* *Soil* *Floodgate*

HUDSON TUNNEL PROJECT

New Tunnel Alignment (Plan and Profile): New Jersey

Figure 2-5

5.21.21



Tunnel
Floodgate
Rock
Soil

HUDSON TUNNEL PROJECT

New Tunnel Alignment (Plan and Profile): Hudson River and New York

Figure 2-6

2.5.2.1.3 Hudson River (New Jersey and New York)

From Hoboken, the new Hudson River Tunnel would continue beneath the bottom of the Hudson River, continuing its gradual descent and then beginning to rise, at a grade of no more than 2.1 percent, so the tracks can meet the existing PSNY approach tracks at A Yard in Manhattan. The top (i.e., crown) of the tunnel would generally be located 25 to 50 feet below the river bottom for much of its length across the Hudson. However, beginning approximately 1,300 feet west of the Manhattan shoreline, an approximately 550-foot-long section of the tunnel would be shallower beneath the river bottom than the minimum depth suitable for tunnel boring, which is 14 feet, or half the diameter of each new tube, below the river bottom. As described in Chapter 3, "Construction Methods and Activities," Section 3.3.5, in this area the river bottom would be hardened through the addition of grout to the soil to provide more stability above the tunnel; as a result of the addition of cement or cement grout, a portion of this area would be up to 2 feet above the existing river bottom but still below the required depth for the navigation channel. The eastern edge of the ground improvement area would be approximately 70 feet west of the New York pierhead line. The pierhead line is the legal boundary established as the farthest point to which piers and other structures may legally extend into otherwise navigable waters.

2.5.2.1.4 Manhattan (New York)

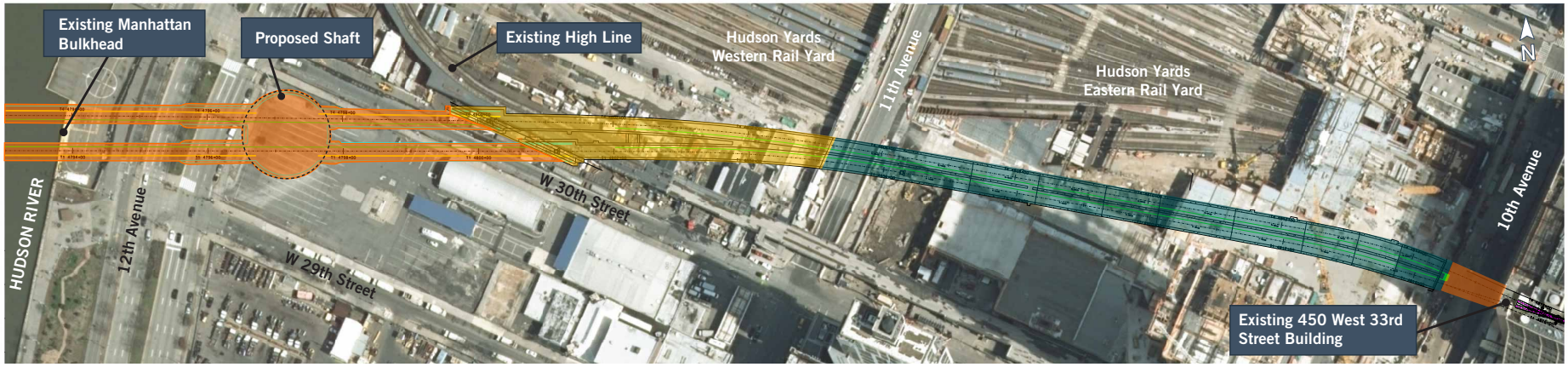
At the Manhattan shoreline, the new Hudson River Tunnel would pass beneath the bottom of the Hudson River bulkhead, below the bottom of the river. It would pass through the pile foundation of the bulkhead, continuing at a depth of about 45 feet beneath Hudson River Park and Twelfth Avenue, across the western edge of the block between Twelfth Avenue and Eleventh Avenue from West 29th to West 30th Street, and across West 30th Street.

On the north side of West 30th Street, the Preferred Alternative would use the right-of-way that is being created by the Hudson Yards Right-of-Way Preservation Project for the new tunnel alignment. As a separate initiative from the Hudson Tunnel Project, the Hudson Yards Right-of-Way Preservation Project is constructing a concrete casing beneath the West Side Rail Yard to preserve a rail right-of-way beneath the Hudson Yards platform and overbuild project. The Hudson Tunnel Project would include construction of two new tracks and associated rail systems within the concrete casing. The right-of-way extends to the western edge of Tenth Avenue (between 30th and 32nd Streets), crossing beneath the Eleventh Avenue viaduct and approximately 50 feet above the No. 7 subway line, which runs under Eleventh Avenue. At the end of the Hudson Yards Right-of-Way Preservation Project, the new tunnel would continue beneath Tenth Avenue to a new portal just east of Tenth Avenue, near the portals of the North River Tunnel and Amtrak's Empire Line. The two existing portals are located beneath the existing building on the east side of Tenth Avenue between 31st and 32nd Streets (450 West 33rd Street). Just east of the new Tenth Avenue portal, the Preferred Alternative would connect to the PSNY tracks at A Yard at approximately Ninth Avenue.

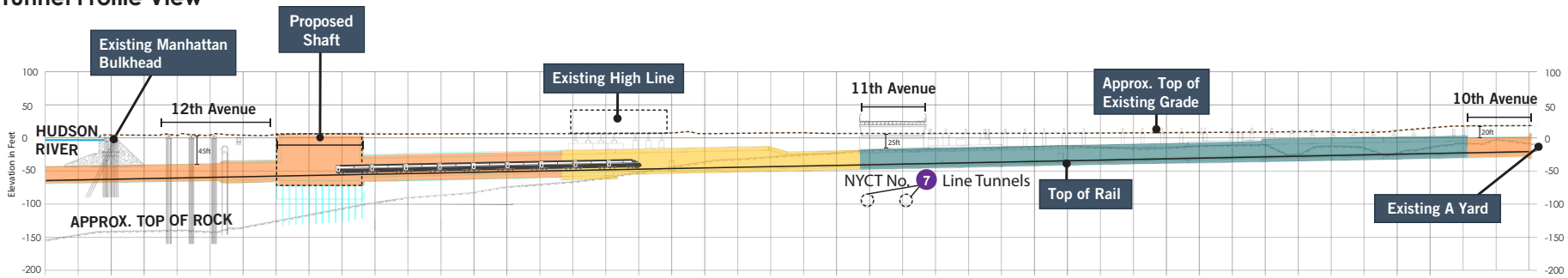
Figures 2-6 and 2-7 illustrate the Manhattan segment of the Preferred Alternative.

The Preferred Alternative includes a vertical shaft from the tunnel to the surface on a site just east of the Hudson River, on the block between West 29th and 30th Streets, Twelfth Avenue and Eleventh Avenue. The shaft would provide emergency access/egress to and from the tunnel and would serve as part of the tunnel ventilation system. A fan plant would be located above the shaft. In addition, the Preferred Alternative would include a fan plant above the tracks beneath and within the building at 450 West 33rd Street. More information on the tunnel ventilation system and these fan plants is provided in Section 2.5.2.6 below.

Tunnel Plan View



Tunnel Profile View



Proposed Hudson River Tunnel

Hudson Yards Right-of-Way Preservation in Advanced Design

Hudson Yards Right-of-Way Preservation Constructed

HUDSON TUNNEL PROJECT

New Tunnel Alignment (Plan and Profile): New York

Figure 2-7

2.5.2.2 TUNNEL DESIGN

Like the North River Tunnel, the new Hudson River Tunnel would consist of two separate tubes, each containing one track.

Each tube would have an internal diameter of approximately 25 feet, 2 inches, which is the size required to accommodate passenger trains, railroad systems (e.g., trackbed, utility lines, an overhead contact system to power the trains, ventilation ducts, and drainage), and space for emergency egress and maintenance. The tunnel would be lined with pre-cast circular concrete rings, creating a thick concrete structure with an outside diameter of approximately 28 feet. **Figure 2-8** provides a typical cross section of the tunnel.

The tunnel would have a grade (slope) of no more than 2.1 percent, needed for efficient operation of Amtrak and NJ TRANSIT passenger trains. Given the train lengths (and resulting weight) of NJ TRANSIT commuter trains serving PSNY, this is the steepest grade for NJ TRANSIT trainsets in terms of operational reliability. A steeper grade could mean that a heavy dual-mode locomotive or double-height train may not be able to safely ascend the slope.

The two tubes of the new Hudson River Tunnel would be connected by cross passages approximately every 750 feet, for a total of 15 cross passages. Cross passages would be provided in both the land portion and the river portion of the tunnel. Fire-rated doors would be located at the start of the cross passages in each tube to separate the tubes.

Each tube of the tunnel would include two bench walls, one on each side of the trackbed. The bench wall on the inner tunnel wall (i.e., the wall that connects to the cross passages) would have a height of 4 feet above the top of rail, and would serve as a walkway for evacuation of passengers from a train in an emergency. Several utilities would run along the tunnel wall above this high bench and within the high bench in a conduit system, including a fire standpipe, sump pump discharge pipe, tunnel lighting, emergency blue light boxes, coaxial radio cables, and train signals. This bench wall is referred to as the high bench.

On the outer wall of the tunnel, the bench wall would be lower (the low bench), at the height of the top of rail. Additional utilities would be located on the tunnel wall above the low bench wall and in the low bench conduit system, including power cables for traction power and tunnel ventilation, signal conduits, and radio and communications conduits.

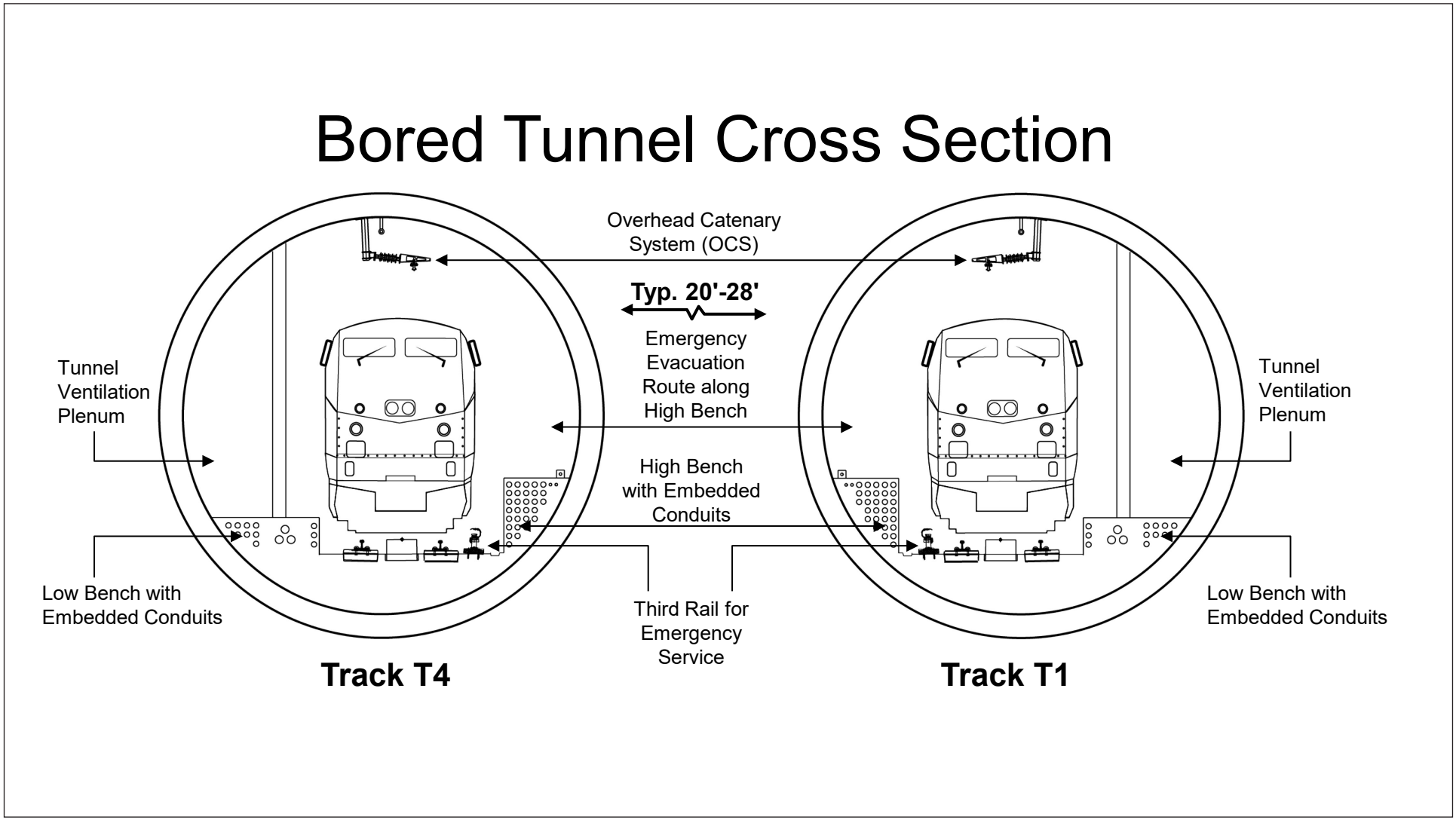
The tunnel would be designed to comply with the fire-life safety standards established by the National Fire Protection Association (NFPA), and particularly NFPA 130, “Standard for Fixed Guideway Transit and Passenger Rail Systems.” It would also comply with relevant Federal, state, and local standards and guidelines and those of Amtrak and NJ TRANSIT.

2.5.2.3 TRACK

Track in the new Hudson River Tunnel would be continuous welded rail with a direct fixation (i.e., ballastless) rail system, which is the state of practice for rail tunnels. Direct fixation track systems generally provide better track stability, reduced maintenance requirements, and increased service life relative to ties and ballast. In the recommended track system, the rails would be affixed to precast concrete tie blocks resting on engineered polyurethane pads that are encased in rubber “boots” to absorb wheel impacts. The polyurethane pads under the tie blocks provide vibration damping that is similar to ballasted track.

2.5.2.4 TUNNEL DRAINAGE

A drainage system would be provided under the track slab to remove any stormwater that enters the tunnel, through the portals, seepage in the tunnel liner, or at the ventilation shafts. The drainage system would also serve fire-fighting operations. As noted below in the discussion of



HUDSON TUNNEL PROJECT

Typical Tunnel Cross Section:
New Tunnel
Figure 2-8

power (Section 2.5.4.1) an emergency power supply system would enable the pumps to remain operative during power outages. Stormwater would be pumped from the tunnel via sump pumps in the tunnel's three fan plants and discharged to the local sewer system. In Manhattan, water removed in the tunnel from the Twelfth Avenue shaft would be discharged to the city combined sewer downstream of the regulator, requiring a NYSDEC SPDES permit. The recovered water would be treated in accordance with permit requirements prior to being conveyed to the Hudson River.

2.5.2.5 UTILITIES

The new tunnel would include space for trans-Hudson utilities and possible third-party telephone transmission lines across the river, which would be available for installation as part of separate projects undertaken by the individual telephone service providers.

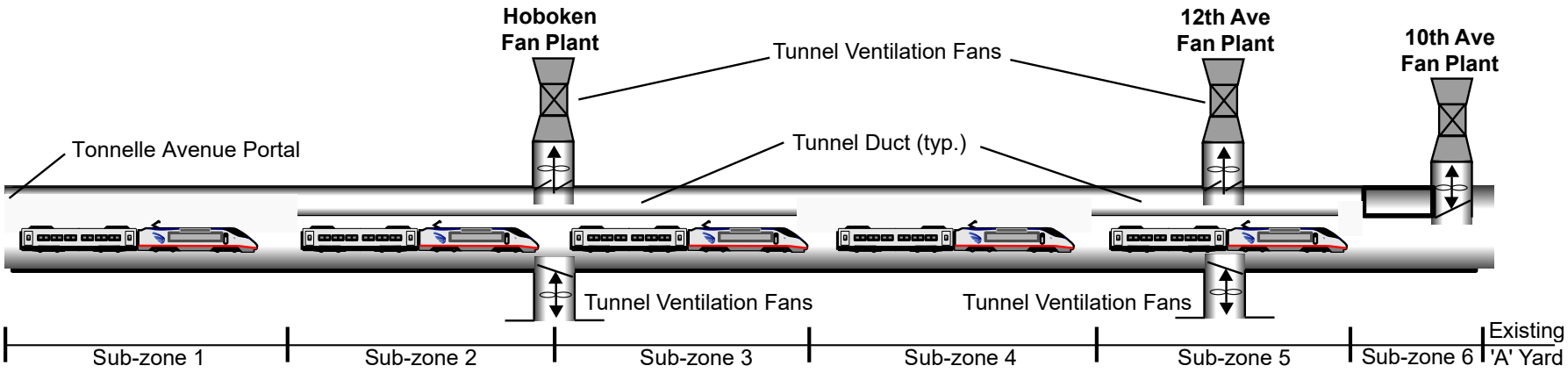
During construction (discussed in Chapter 3, "Construction Methods and Activities"), utilities located within the Project alignment would be relocated as necessary to facilitate construction. For the new tunnel component of the Preferred Alternative, this would occur at the Hoboken ventilation shaft site and the two Manhattan locations where excavation across city streets would occur: West 30th Street and Tenth Avenue. (Utility relocation for the surface alignment is discussed earlier, in Section 2.5.1.5.)

2.5.2.6 TUNNEL VENTILATION

The new Hudson River Tunnel would have a ventilation system designed to bring fresh air into the tunnel passively, through normal train movement. It would also have an active component, driven by low-pressure and high-pressure fans. The low-pressure fans would remove hot air from the tunnel during congested (i.e., perturbed) conditions, which occur when trains are stopped or moving slowly for extended periods, particularly during the summer. The high-pressure fans would be used to control and exhaust hot air and smoke during emergency conditions, such as a fire on a train in the tunnel. High-pressure fans would move smoke so that smoke-free emergency routes are available for safe evacuation of passengers and fire-fighting operations. Smoke would be pulled away from the train to allow passengers to exit to the nearest cross passage upstream of the fire.

The Hudson Tunnel Project's ventilation design includes four ventilation supply/exhaust locations that would each serve both tubes of the new Hudson River Tunnel. These would create six ventilation zones in each tube of the new tunnel. Ventilation zones are tunnel segments within which smoke can be contained during emergencies, based on coordinated operations at the supply/exhaust facilities serving those segments. To comply with the fire-life safety standards of NFPA 130, the Hudson River Tunnel's signal system would be designed so that only one train would operate in each vent zone, which would allow safe evacuation of trains operating in the tunnel in the event of a fire in one train. Using the exhaust/intake facilities, smoke could be pushed and/or pulled in a specific direction to be exhausted out of the Hudson River Tunnel, so that it could be directed away from other trains in the tunnel at the same time. Having six vent zones would support a tunnel capacity of at least 24 trains per hour in each direction while the North River Tunnel is being rehabilitated, the same level of operation as the existing North River Tunnel has today (see Section 2.5.7 for information on operations of the new Hudson River Tunnel during rehabilitation of the North River Tunnel and upon completion of the entire Hudson Tunnel Project).

The ventilation design is illustrated in **Figure 2-9**. As shown in **Figure 2-9**, to support six vent zones, the new Hudson River Tunnel would have intermediate fan plants on each side of the Hudson River (in Hoboken in New Jersey and at Twelfth Avenue in New York) as well as additional supply/exhaust points at each of the tunnel portals (the portal at Tonnelle Avenue in



HUDSON TUNNEL PROJECT

Hudson River Tunnel Ventilation Design

Figure 2-9

New Jersey and the below-grade portal at Tenth Avenue in New York, connected to outside air via a fan plant). Placing the fan plants close to the water's edge on each side of the river would maximize the capacity of the new tunnel.

The three fan plants at Hoboken, Twelfth Avenue, and Tenth Avenue would connect to the ventilation duct system within the two tubes of the Hudson River Tunnel. At Hoboken and Twelfth Avenue, where the tunnel would be deep below grade, a ventilation shaft from the tunnel level to the surface would provide the connection to the fan plant. At Tenth Avenue, the tunnel would be immediately below the fan plant and no shaft would be needed. The fan plants would include reversible tunnel ventilation fans that connect to the tunnel by a configuration of ventilation ducts (i.e., plenums) and dampers. These fans, in conjunction with the ventilation ducts in the tunnel, would provide push-pull ventilation in the tunnel: the fans would push clean air into the tunnel from one end of the vent zone and pull hot air and smoke out at the other end of the vent zone. In addition, the tunnel ventilation shafts would have additional shafts connected to each tube to allow train-generated airflow to be exchanged with the outdoor ambient air, without the use of fans.

A plenum would run along the outer wall of each tube of the tunnel above the low bench. The plenum would be at the tunnel ceiling in the segments of tunnel in Manhattan that have a square rather than circular profile—those located in the Hudson Yards Right-of-Way Preservation Project or constructed by underground mining without a tunnel boring machine. The ventilation plenum would supply outside air and remove smoke in the event of a fire in the tunnel.

Ventilation would be provided from the new tunnel's three fan plants, discussed below in Section 2.5.2.7. During normal operations, the fan plants would generally operate passively (fans would not run, and ventilation would occur naturally through train movement in the tunnel). Low pressure fans would operate during congested train conditions to clear hot air from the tunnel and high-pressure fans would operate during emergencies to exhaust smoke from the tunnel. The fans would also be tested regularly to ensure they remain operational. Sound attenuators would be included in the fan plants to reduce fan noise and meet applicable noise code requirements.

Under normal circumstances, no diesel-powered trains would operate within the new Hudson River Tunnel. Diesel trains cannot be accommodated in PSNY and therefore the new tunnel's ventilation systems have not been sized to handle diesel exhaust. NJ TRANSIT could operate its dual-mode locomotives[11] in electric mode through the new tunnel, as it does today in the North River Tunnel. However, in certain extremely limited circumstances, Amtrak and NJ TRANSIT may operate diesel trains in the new tunnel, as they do in the existing North River Tunnel. For example, this could occur if a train is stranded in the new tunnel and passengers need to be evacuated with a rescue train and electric propulsion cannot be used; it could also occur for certain limited maintenance activities (e.g., repairs to the catenary system when no third-rail-powered locomotive is available). In these events, the ventilation fans would also serve to exhaust diesel emissions.

2.5.2.7 ANCILLARY FACILITIES

The Preferred Alternative would include three ancillary facilities outside of the rail right-of-way. As discussed below, these facilities would be located at the Project's three fan plants and each one would include the ventilation function, emergency access, a substation, and a sump pump as part of the tunnel drainage system. The fan plants would also include communications and train systems rooms, signal equipment, controls for the tunnel's ventilation system, and

[11] Dual-mode locomotives can be operated using either electric or diesel power.

connecting conduits from the substation to the tunnel's two tubes, ventilation facilities, and communications and train system rooms.

The three fan plants would house large high- and low-pressure tunnel fans to provide normal and emergency ventilation to the tunnel (as discussed above in Section 2.5.2.6). The fans in the Hoboken and Twelfth Avenue fan plants would be 8 feet in diameter and the fans in the Tenth Avenue fan plant would be 6 feet in diameter.

Substations on site at each ancillary facility would provide power to the fan plants. The fan plant substations would also provide power to tunnel lighting, communication and signal systems, and traction power sectionalizing. Each substation would have a battery plant that could provide 90 minutes of reserve power.

The Hoboken and Twelfth Avenue ancillary facilities would also include separate emergency egress paths from each tube of the tunnel to street level.

2.5.2.7.1 Hoboken Ancillary Facility

An ancillary facility housing a tunnel ventilation shaft and fan plant would be located in New Jersey on a vacant site previously acquired by NJ TRANSIT for the ARC Project. The site is predominantly in Hoboken but also includes small areas that are in Union City and Weehawken. This site is located on the south side of West 18th Street, just north of the HBLR right-of-way, and adjacent to the eastern face of the Palisades. It consists of Block 136, Lot 6.02; Block 142, Lot 1; Block 143, Lots 2 and 3; Block 144, Lots 2 through 19; and Block 145, Lots 1.2, 2, 3, 4, 10, 11, 12.1, and 12.2, all in Hoboken; Block 2, Lots 1, 2, and 3 in Weehawken; and Block 192.01, Lot 1 in Union City. The proposed ventilation shaft and ancillary facility would be located entirely on the Hoboken portion of the site and would front on West 18th Street.

The Hoboken fan plant, working in conjunction with the portal at Tonnelle Avenue and the Twelfth Avenue fan plant in Manhattan, would provide ventilation to the new Hudson River Tunnel between the Tonnelle Avenue portal and the Twelfth Avenue fan plant. This would include supplying outside air and removing smoke in the event of a fire in the tunnel. In addition, the ventilation system would also operate during congested train conditions to provide fresh air to the tunnel and exhaust hot air.

At this location, an approximately 130-foot-diameter vertical shaft would connect the two tubes of the tunnel, approximately 75 feet below ground, to the surface. The shaft would house a ventilation shaft connected to a fan plant above. The fan plant would house fans, ventilation, signals, and communications equipment, a substation, and emergency access. A sump pump would be located at the shaft site at track level. The shaft and fan plant would also serve as an emergency egress and access point for the tunnel below.

Based on preliminary design, the fan plant would occupy a footprint of approximately 250 to 300 feet by 150 to 200 feet and would be approximately 65 to 80 feet high. The fan plant is being designed to comply with the Project's design flood elevation (DFE) criterion, in recognition of the flood levels at the site during Superstorm Sandy (see Chapter 14, "Greenhouse Gas Emissions and Resilience," Sections 14.3.6.1 and 14.3.6.2), which requires that critical equipment in the fan plant be raised above the DFE. The shape, size, and design treatment of the fan plant will be further refined during advanced engineering. The Hoboken fan plant will be designed to be visually compatible with the character of the surrounding area. The Project Sponsor will coordinate with the local community and seek input in determining the appropriate design for the visible portions of the fan plant. See **Figure 2-10** for a conceptual illustration of the Hoboken fan plant.

Note: Images are illustrative and conceptual, and are subject to change as design advances

HUDSON TUNNEL PROJECT

Hoboken Fan Plant, View North
(Conceptual Artist Rendering)
Figure 2-10

The fan plant would generally be unstaffed on-site, and little activity would occur at the site, other than visits by maintenance workers who need access to the tunnel below or to the equipment within the fan plant.

2.5.2.7.2 Twelfth Avenue Ancillary Facility

On the Manhattan side of the river, an ancillary facility for the Hudson River Tunnel would be located on the block between Twelfth and Eleventh Avenues and West 29th and West 30th Streets (Manhattan Block 675), in the western portion of the block. The site where the ancillary facility would be located is Lot 1 of Block 675. Like the Hoboken facility, this facility would include an approximately 130-foot-diameter vertical ventilation shaft connecting to the tunnel below, and a fan plant housing the large fans and other infrastructure needed for the tunnel ventilation system, a substation for the ventilation system and third-rail traction power, and communications and signal equipment. A sump pump would be located at the shaft site at track level. The shaft and fan plant would also serve as an emergency egress and access point for the tunnel below. In Manhattan, the tunnel alignment would be shallower than in Hoboken (approximately 35 feet below the surface at the shaft site), since the tunnel must connect to PSNY nearby. For this reason, less ventilation equipment (such as tunnel fans) could be located below grade and instead, the tunnel fans must be located above grade.

The Twelfth Avenue fan plant, working in conjunction with the Hoboken fan plant and Tenth Avenue fan plant, would provide ventilation to the Hudson River Tunnel between the Hoboken fan plant and the Tenth Avenue fan plant. This would include supplying outside air and removing smoke in the event of a fire in the tunnel. In addition, the ventilation system would also operate during congested train conditions to provide fresh air to the tunnel and exhaust hot air. The fan plant would generally be unstaffed on-site, and little activity would occur at the site, other than visits by maintenance workers who need access to the tunnel below or to the equipment within the fan plant.

The tunnel alignment would cross Block 675 at the western end of the block, close to Twelfth Avenue. Therefore, the new ventilation shaft would also be located at that end of the block, at approximately the corner of Twelfth Avenue and West 30th Street. The new fan plant would be at or near this location; if it is not directly above the shaft, it would need to accommodate additional ventilation plenums and space for other connections between the shaft and the fan plant.

Amtrak would acquire the site of the Twelfth Avenue fan plant on behalf of the Project, as well as the tunnel alignment across the block, through an easement or fee acquisition. This may be an acquisition of a portion of the property (Block 675 Lot 1) or potentially all of the property.

The site where the Twelfth Avenue ventilation shaft and fan plant are proposed (Block 675 Lot 1) is currently privately owned. The property owner may have an interest in redeveloping the site. A 2020 news article reported that the owner is planning a large office building for this site, consistent with the site's current zoning.[12]

The preliminary design for the Hudson Tunnel Project does not identify a specific location, massing, bulk, or height for the Twelfth Avenue fan plant, to retain flexibility for future coordination with the owner of Lot 1. The fan plant could potentially be incorporated within a separate development on Lot 1, such as a future commercial building, or it could be developed independently on the property. Design of the fan plant could also be coordinated with planned developments on the western end of the block. The shape, size, specific location on Block 675 Lot 1, and design treatment of the fan plant will be refined during advanced engineering.

[12] https://www.commercialcafe.com/blog/georgetown-1msf-office-tower-chelsea/.

Two possible locations for the fan plant on Lot 1 would be: a corner site at Twelfth Avenue and West 30th Street, and a midblock site on West 29th Street east of Twelfth Avenue. The corner location would be more efficient, as it would place the fan plant directly above the associated ventilation shaft. However, depending on the final shape and massing, this could interfere with views to the Hudson River from the High Line, a public park located on the north side of West 30th Street. The midblock location on West 29th Street would preserve this view and would allow any subsequent private development on Lot 1 to take better advantage of the development potential at the corner of Twelfth Avenue and West 30th Street. At the same time, this midblock location would be more complicated and expensive to construct, as a large plenum would be needed to connect the ventilation shaft to the fan plant.

In any location on Lot 1, the fan plant could be developed with the tunnel fans oriented vertically or horizontally, and could be freestanding, adjacent to, or integrated with a development built by another party as a separate project. A configuration with the tunnel fans oriented vertically would require a footprint of approximately 120 feet by 130 feet and a maximum height of approximately 150 feet. A configuration with the tunnel fans oriented horizontally would result in a lower building with a larger footprint; the specific dimensions would depend on how much is included on each floor of the building. **Figure 2-11** illustrates the potential massing of the Twelfth Avenue fan plant with a vertical configuration.

Regardless of its location and configuration, the Twelfth Avenue fan plant would be designed to be compatible with the character of the surrounding area. The Project Sponsor will coordinate with the New York City Department of City Planning (NYCDCP) and Community Board 4 regarding the design of visible elements of the fan plant.

2.5.2.7.3 Tenth Avenue Ancillary Facility

A fan plant to serve the new Manhattan portion of the tunnel east of Twelfth Avenue would be located above the tunnel portal and A Yard tracks. This fan plant would be located beneath the building at 450 West 33rd Street. It would have ventilation fans, ducts, and an electric substation beneath the building and within unused space at the base of the building. A track-level sump pump would also be located at this fan plant site.

Today, the building at 450 West 33rd Street has horizontal metal slats (i.e., air louvers) on its western façade along Tenth Avenue, just above the sidewalk (see **Figure 2-12**). These air louvers provide passive airflow (i.e., without mechanical ventilation or fans) for the tracks below, including the North River Tunnel and Empire Line tunnel portals. In the event of a fire, hot smoke from the A Yard track area would flow through the louvers toward Tenth Avenue. Adjacent to the louvers, an existing door provides emergency access to the tracks for emergency responders; such access would remain with the Preferred Alternative.

The Tenth Avenue fan plant, working in conjunction with the Twelfth Avenue plant, would provide ventilation to the segment of the Hudson River Tunnel between Twelfth and Tenth Avenues. This would include supplying outside air and removing smoke in the event of a fire in the tunnel. In addition, the ventilation system would also operate during congested train conditions to provide fresh air to the tunnel and exhaust hot air.

Based on preliminary design, a fan plant would be constructed under the foundation girders of 450 West 33rd Street and above the tracks. An air duct would connect the fan plant to the building's exhaust louvers along Tenth Avenue. In the event of a fire in the Manhattan segment of the new tunnel, the fan plant at 450 West 33rd Street would work in conjunction with the Twelfth Avenue fan plant to clear smoke from the tunnel, exhausting it at either the louvers along Tenth Avenue or at the Twelfth Avenue fan plant. The presence of the fan plant beneath the building at 450 West 33rd Street would also serve to protect the building from hot temperatures associated with the smoke by creating a barrier between the building and the tracks below.

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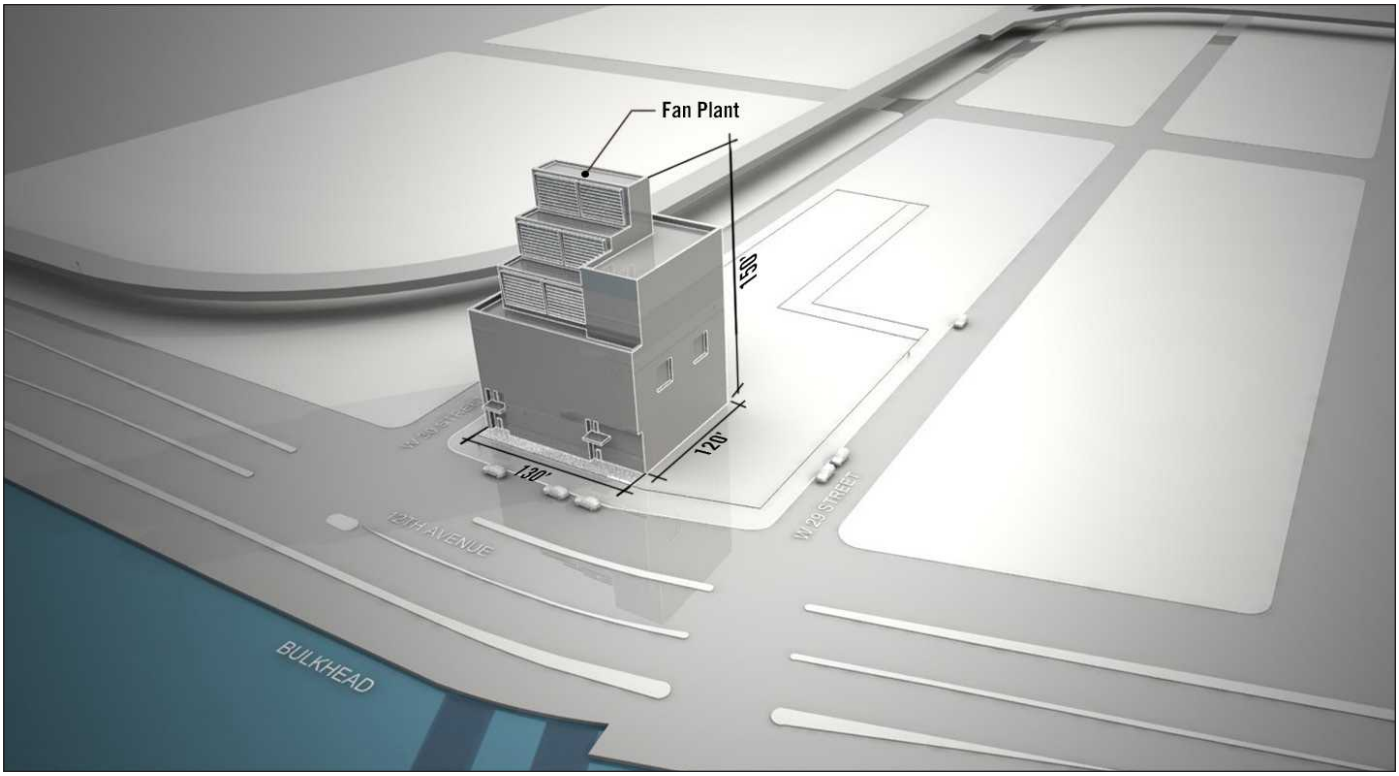
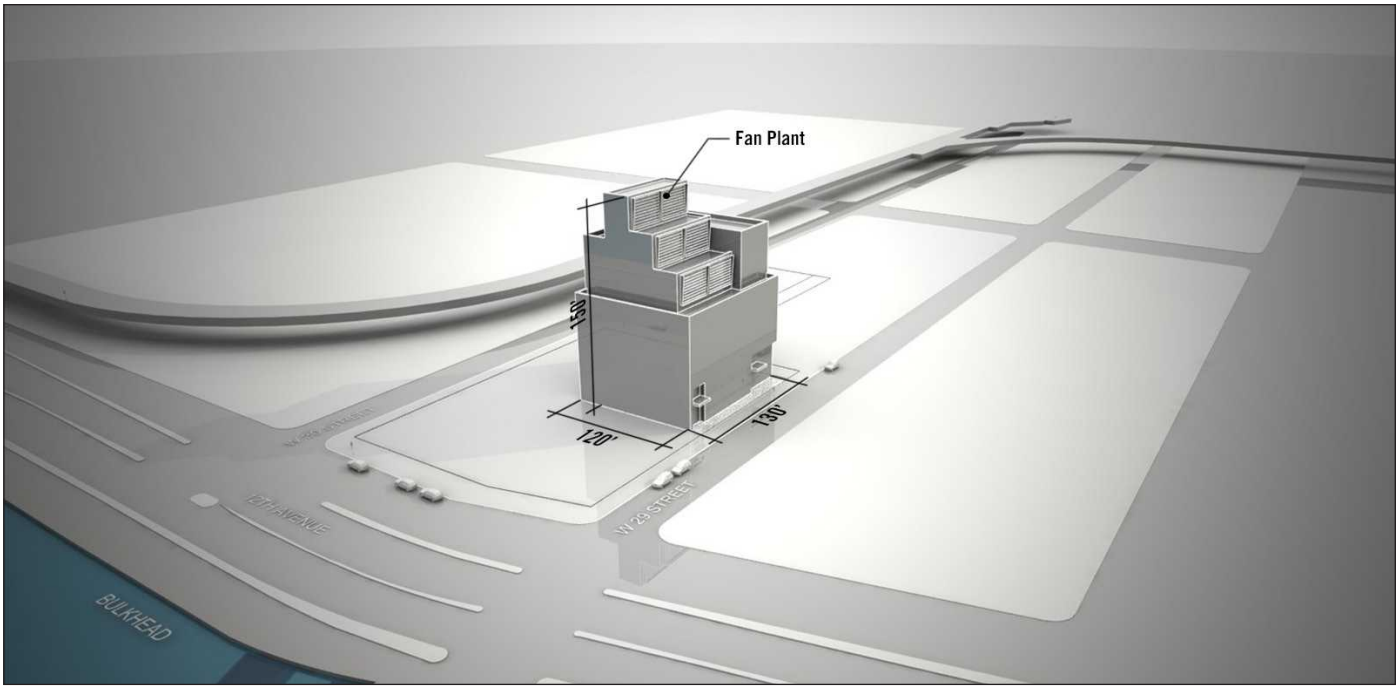


Vertical Fans: West 30th Street Location **1**



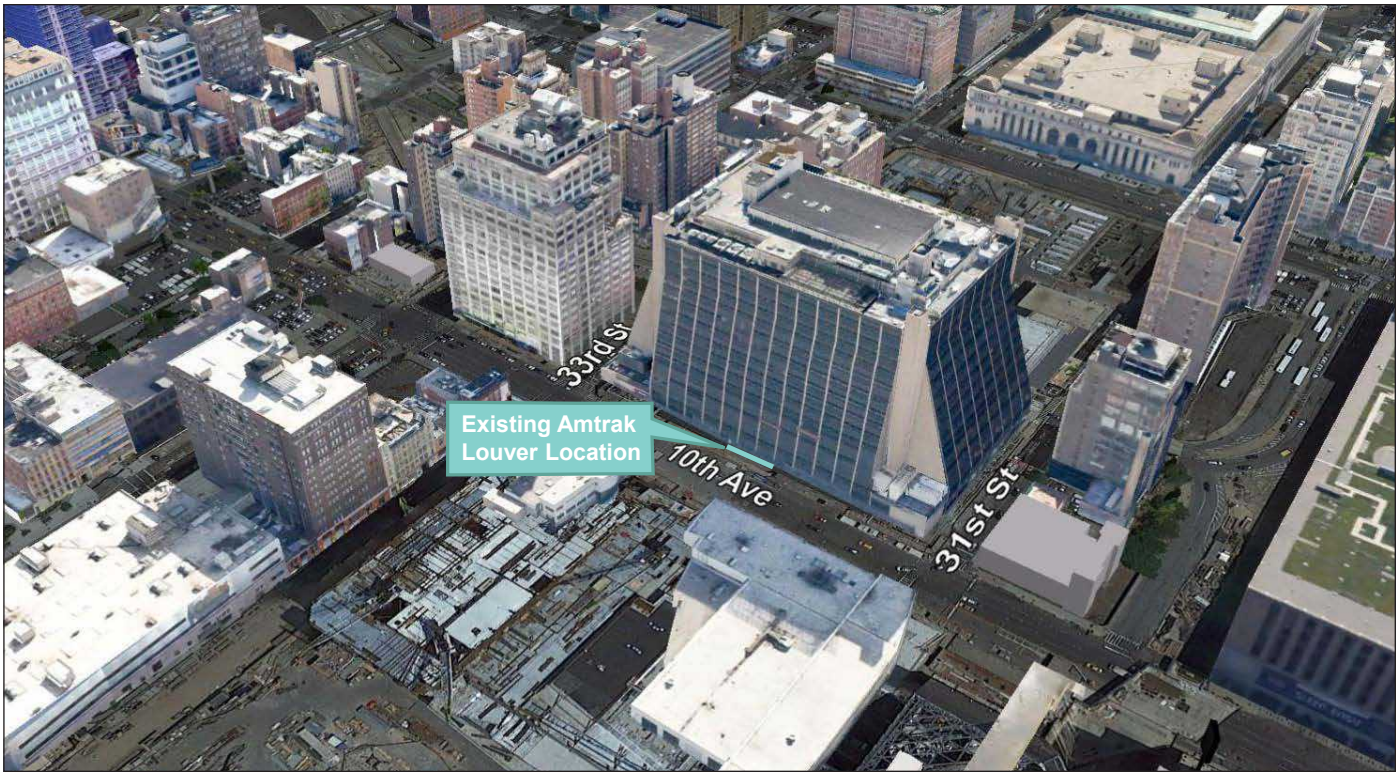
Vertical Fans: West 29th Street Location **2**

Note: Images are illustrative and conceptual, and are subject to change as design advances

HUDSON TUNNEL PROJECT

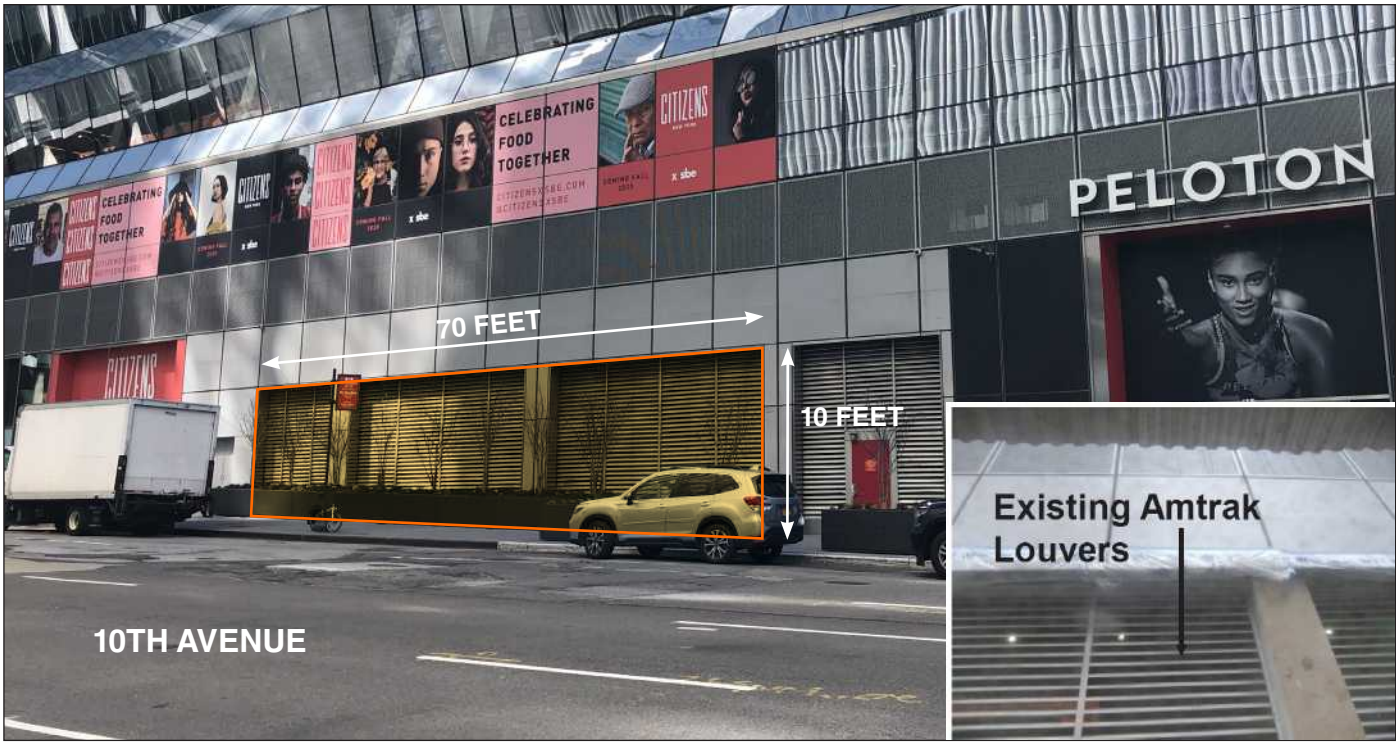
Twelfth Avenue Fan Plant
Potential Massing and Siting Scenarios
Figure 2-11

5.3.21



Photograph date: 2015

Location of existing louvers to be used by new Tenth Avenue fan plant at 450 West 33rd Street **1**



Existing louvers to be used by new Tenth Avenue fan plant **2**

HUDSON TUNNEL PROJECT

Tenth Avenue Fan Plant
Potential Louvers Locations
Figure 2-12

2.5.3 CONNECTION TO PSNY APPROACH TRACKS

East of Tenth Avenue, the two new tracks would connect to the existing PSNY approach tracks at A Yard. Some of the approach tracks would be modified to accommodate the new tunnel's tracks. Modifications would include the following:

- An existing track that runs diagonal to the existing track network to provide connections to the PSNY platform tracks, known as the I Ladder, would be extended to connect to the new tunnel's tracks, so that connections are available from the new tunnel to PSNY Tracks 1 through 18.
- Certain tracks within A Yard would be modified. The new tunnel's tracks would connect to two of the A Yard tracks, which would be connected to the station platform tracks via the extended I Ladder and a shorter connection referred to as the J Ladder. Other switches in A Yard would be modified to support the new tunnel operations. The reconfigured A Yard would have three storage tracks, providing similar capacity to the storage tracks present today.
- Track profiles beneath the building at 450 West 33rd Street would be modified to accommodate the new tracks. Specifically, certain tracks in A Yard must be lowered to meet the alignment of the Hudson River Tunnel tracks.

Figures 2-13a and 2-13b illustrate the existing track layout and proposed track modifications at A Yard.

2.5.4 RAILROAD SYSTEMS AND FEATURES

The new tracks and tunnel would be designed with railroad systems that would accommodate the anticipated future service plan once the Preferred Alternative is in operation. The systems would also be designed to allow for a future increase in train service, if capacity improvements at PSNY and on the NEC are implemented.

2.5.4.1 POWER

2.5.4.1.1 Traction Power

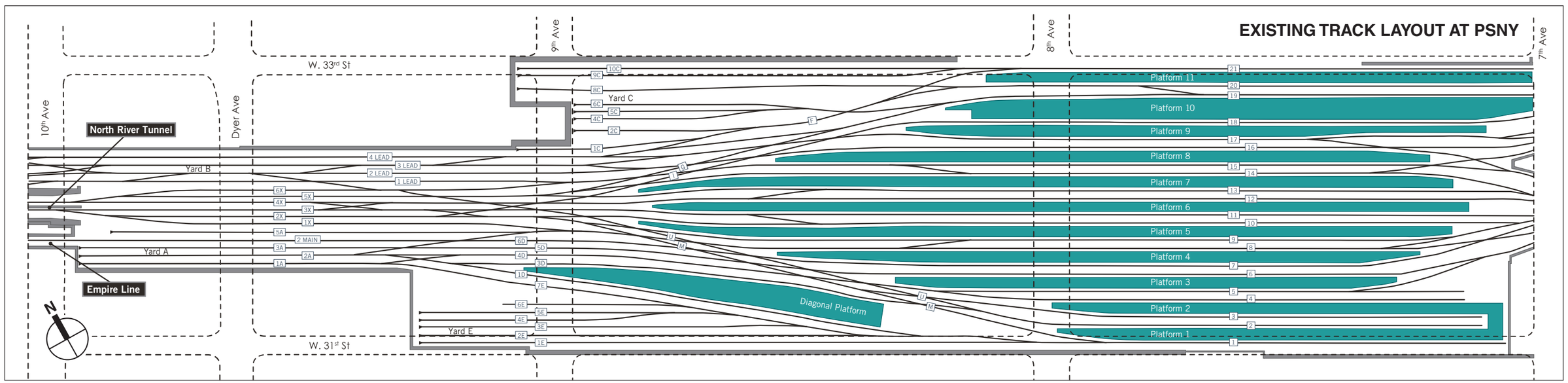
Trains operating on the new track and in the new tunnel would be electrically powered. Traction power (i.e., electricity for the trains) would be provided via an overhead contact system as it is on nearby sections of the NEC and throughout NJ TRANSIT's system today. Power would be provided from Amtrak's existing 12 kV, 25 Hz power system from two existing NEC substations, Substation 42 on the west side of Tonnelle Avenue in North Bergen, New Jersey and Substation 43, within PSNY. The system would be designed to accommodate a future increase in capacity on the NEC.

To accommodate the Preferred Alternative, Amtrak's 12 kV, 25 Hz traction power substations would be modified. The existing infrastructure at the tie-in locations at Allied Interlocking and A Yard would be modified. For more information, see Chapter 17, "Utilities and Energy," Section 17.7.

Modifications to the overhead contact system infrastructure, including wiring and support structures, would accommodate the track modifications and new tracks of the Preferred Alternative in the vicinity of Allied Interlocking. In addition, new, independent catenary support structures similar to those along the existing NEC would be located above the new tracks as they diverge from the NEC.

In the new tunnel, the overhead contact system would be affixed to the top of the tunnel. In addition, the new tunnel would be equipped with third-rail power adjacent to the low bench wall

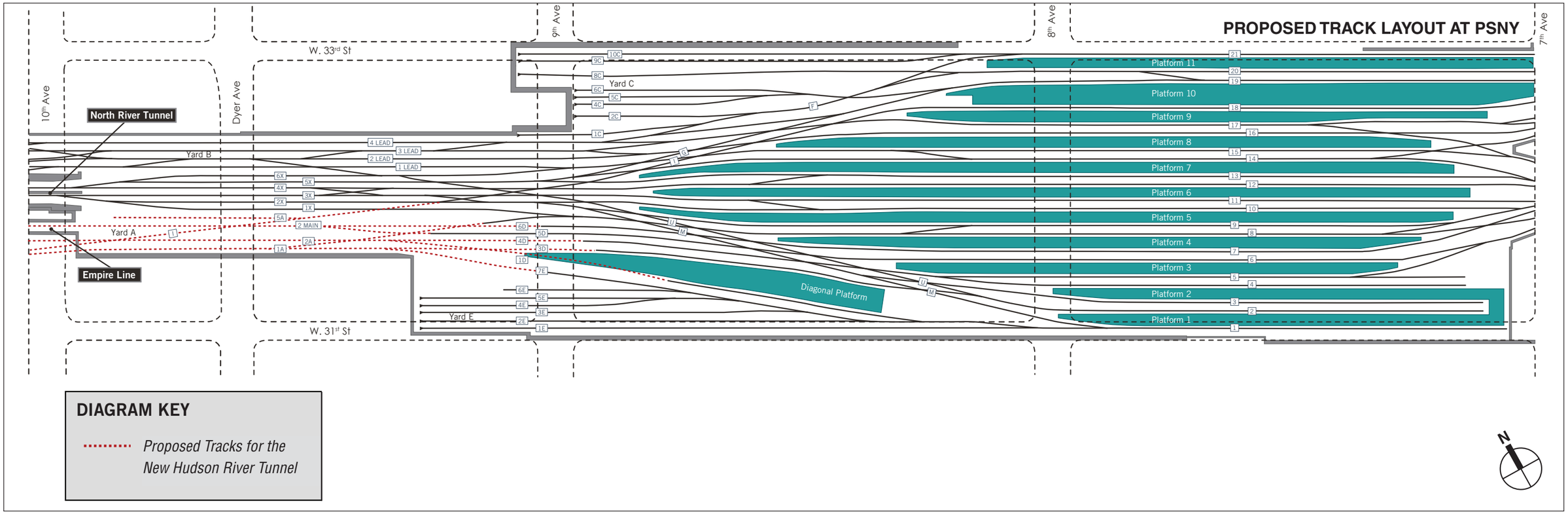
3.30.21



HUDSON TUNNEL PROJECT

Existing Track Layout at PSNY
Figure 2-13a

3.30.21



HUDSON TUNNEL PROJECT

Proposed Track Layout at PSNY
Figure 2-13b

that could be used to rescue a stranded train and could potentially be used by LIRR trains in the future. The North River Tunnel is similarly equipped with both an overhead contact system and third-rail power today.

2.5.4.1.2 Signal Power

A new signal power line would be routed along each new track through the tunnel to provide power to the new signal system. In addition, backup power for signaling would be provided from the fan plant substations.

2.5.4.2 SIGNALS

The signal system for the Preferred Alternative would be similar to what is present on the existing NEC. In the western, surface portion of the alignment, signals would be on vertical structures, similar to the existing signals, with signal logic in signal bungalows along the right-of-way. Some existing signal bungalows would have to be relocated to accommodate the new tracks. Within the new tunnel, tunnel vent zone signals would be on the tunnel wall. The signal system would be designed to maximize operations of passenger trains at 60 mph and the signal block layout and control lines would be optimized for peak period traffic. The signal system would also be designed to support future conditions once other capacity improvement projects are in place, when all four tubes beneath the river may be used at increased capacity.

The new signal system, working in conjunction with the communication systems (see Section 2.5.4.3 below), would be the Positive Train Control (PTC) system used throughout the NEC. The PTC system on the NEC is a transponder-based train control system that prevents train accidents by automatically controlling train speeds and movements should a train operator fail to take appropriate action for the conditions at hand.

2.5.4.3 COMMUNICATION SYSTEMS

The new tracks and tunnel would include communication systems to enable train operators to communicate with Amtrak and NJ TRANSIT operations and maintenance staff, security and railroad police, emergency responders, and the traveling public. The communication system would interface with fire-life safety systems, such as the fire alarm system. The communication systems design would incorporate fiber optics and copper cable, data radio for the PTC system, two-way radio, wireless cellular services, network equipment and computers, telephone systems including blue light emergency telephones, and security systems that include closed caption television, access control systems, and intrusion detection systems. The communication system would also include wireless voice and data communication capability for the traveling public to be built and paid for by third parties (e.g., commercial carriers).

The communication systems would also include the radio frequencies required to support Amtrak's and NJ TRANSIT's PTC systems.

2.5.4.4 SAFETY AND SECURITY / EMERGENCY ACCESS

The tunnel would be designed to comply with NFPA fire-life safety standards, particularly NFPA 130, "Standard for Fixed Guideway Transit and Passenger Rail Systems." It would also comply with relevant Federal, state, and local standards and guidelines and those of Amtrak and NJ TRANSIT.

Consistent with these standards, codes, and guidelines, numerous fire-life safety features would be included in the new tunnel, and are discussed in greater detail in Chapter 18, "Safety and Security," Section 18.7. Some key elements are highlighted below.

- *Emergency walkways and egress/access:* Each tube of the new tunnel would be equipped with an emergency walkway, connected to cross passages located approximately 750 feet apart. The cross passages would have fire-rated doors at each tube, isolating them from the tubes until they are opened. The walkway and cross passages could be used for evacuation in the event of an emergency. Each ventilation shaft (at Hoboken and at Twelfth Avenue) would provide emergency access to and from the tunnel.
- *Emergency power:* Each tube would have an electrified third rail that could be used in an emergency to rescue disabled trains. In addition, substations on site at each of the Preferred Alternative's three fan plants would include systems for reserve power.
- *Tunnel ventilation:* The tunnel ventilation system would be designed to push or pull smoke out of the tunnel, with separate ventilation zones so that a fire condition could be isolated and smoke moved to maintain a clear area for evacuation or for emergency responder access.
- *Communications:* The Project would include communication systems to communicate with security, police, and emergency responders. They would also include fire alarm systems and blue light emergency telephones within the tunnel.
- *Automated fire detection systems* in the tunnel.
- *Standpipes* to provide water for firefighting and tunnel drains sized to accommodate firefighting activities.
- *Other fire-life safety equipment*, including emergency lighting and signage.

Amtrak will coordinate with the Fire Department of New York and emergency responders in New Jersey (i.e., the North Hudson Regional Fire Rescue and Hoboken Fire Rescue) to develop a response plan in advance of tunnel construction and operation. In addition, Amtrak and NJ TRANSIT operating crews are trained regarding potential threats to safety and security. Both organizations have policies and protocols in place to react to security threats and emergency situations. Amtrak, NJ TRANSIT, and the PANYNJ work together to coordinate their approach to security threats and emergencies. Further, the PSNY Emergency Preparedness Task Force assesses threats and vulnerabilities at PSNY, conducts drills, and coordinates safety and security activities of the railroads that use PSNY. A fire-life safety committee ensures appropriate coordination among emergency responders and agencies within PSNY. Additionally, the Project Partners have coordinated and will continue to coordinate with the U.S. Department of Homeland Security's Transportation Security Administration. The Department of Homeland Security is a Participating Agency for the Project.

2.5.4.5 RESILIENCY / FLOOD PROTECTION

During Superstorm Sandy in 2012, seawater entered the North River Tunnel from Manhattan. The low-lying West Side Yard was inundated, and water flowed from the yard into the North River tunnel portal at Tenth Avenue and its ventilation shaft at Eleventh Avenue. With the new Hudson River Tunnel, the Project Sponsor would incorporate measures to protect the new tunnel from flooding and storm damage such as the damage incurred to the North River Tunnel during Superstorm Sandy. In addition, the rehabilitated North River Tunnel would also incorporate additional resiliency measures (discussed below in Section 2.5.6.9).

Similar to the existing North River Tunnel, the new Hudson River Tunnel would also have a portal within the railyard complex west of PSNY in Manhattan at approximately Tenth Avenue. The Tenth Avenue fan plant would also be within the railyard complex close to this portal. These features and the Hudson River Tunnel's new Twelfth Avenue ventilation shaft would be within the flood zone as defined by the Federal Emergency Management Agency (FEMA) on its Flood Insurance Rate Maps (FIRMs). FEMA's flood maps indicate the area where flooding will occur

during the 1 percent probability storm[13] and the Base Flood Elevation (BFE), which is the elevation of floodwaters during that storm. The New Jersey portal of the new Hudson River Tunnel at Tonnelle Avenue would be above the flood zone as defined by FEMA's FIRMs and not subject to flooding during the 100-year or 500-year storm (this designation is consistent with the fact that storm waters did not enter the North River Tunnel from its New Jersey portal during Superstorm Sandy).

The new Hudson River Tunnel would be designed to be resilient to future severe storms. Given the critical importance of the new tunnel and the vulnerability exhibited by the North River Tunnel during Superstorm Sandy, all Project features will be designed using a Design Flood Elevation (DFE) that is five feet higher than FEMA's BFE. Moreover, when Project elements can be designed without substantial financial implications to a more conservative standard, they will be.

The new Manhattan portal at Tenth Avenue and the new Tenth Avenue fan plant would be protected from flooding by a new perimeter wall that the LIRR is planning to construct around its West Side Yard separately from the Hudson Tunnel Project. This project, the West Side Yard Perimeter Protection Project, will be implemented to protect the West Side Yard from flooding during storm events such as occurred during Superstorm Sandy. During Superstorm Sandy, seawater entered the West Side Yard from the Hudson River, damaging critical infrastructure there including trackbeds, switches, and signals, and entering the North River Tunnel's two tubes from their Manhattan portal at Tenth Avenue and their ventilation shaft at Eleventh Avenue. The West Side Yard Perimeter Protection Project will include drainage improvements, a new permanent wall, and additional deployable barriers to be implemented across driveways and access points in advance of storm events. The LIRR wall will surround the West Side Yard (along Twelfth and Tenth Avenues, West 33rd Street and approximately West 31st Streets) and be designed to a DFE of four feet above the BFE, meaning that the new flood protection project will withstand floods that are four feet higher than the currently projected 1 percent probability storm elevations. This project will protect not only the West Side Yard, but also the other existing railroad infrastructure connected to the yard, including the portal and ventilation shaft for the North River Tunnel, the smaller rail storage yards east of Tenth Avenue, and the tracks and platforms at PSNY. The new perimeter wall will also protect the new portal for the Hudson River Tunnel and the Tenth Avenue fan plant, which would be located above the A Yard tracks. The West Side Yard Perimeter Protection Project is being funded by the Federal Transit Administration through a Sandy resiliency grant.

In addition, the new Hudson River Tunnel would include floodgates within the tunnel on both the New Jersey and New York sides of the river, to protect both the tunnel and landside areas (e.g., PSNY) from future flooding such as occurred during Superstorm Sandy. Such floodgates could be deployed in advance of anticipated flooding so they would completely seal off the tunnel, preventing water from passing through. In New Jersey, a floodgate would be located in the tunnel at the ventilation shaft in Hoboken. In New York, floodgates would be located in the tunnel at the Twelfth Avenue ventilation shaft and at the new tunnel's eastern portal beneath the building at 450 West 33rd Street, just east of Tenth Avenue (see **Figure 2-5 and Figure 2-6** for the locations of the floodgates).

The Hoboken and Twelfth Avenue ventilation shafts and associated fan plants for the new Hudson River Tunnel would be located within the 100-year floodplain and below the Project's DFE. Therefore, all entrances and openings would be raised above the DFE or any entrances below the DFE would be watertight. The shafts would include hardening to protect against water

[13] The 1 percent probability storm is sometimes referred to as the "100-year storm" and has a 1 percent probability of occurring in any given year.

incursion and any equipment within the shafts or fan plants would be above the DFE or flood-resistant.

The New Jersey portal for the new tunnel at Tonnelle Avenue would be slightly below the DFE, but the adjacent approach tracks and surrounding areas would be above the DFE. Soil berms and other design features would be included in the Project at this location to prevent floodwater from entering the tunnel.

Other aspects of the new tunnel's design also incorporate resiliency and flood protection measures. Such measures would include the use of concrete for the liner and bench walls that would withstand salt water. See also Chapter 14, "Greenhouse Gas Emissions and Resilience."

2.5.5 RIGHT-OF-WAY REQUIREMENTS

Chapter 6B, "Property Acquisition," describes the properties that the Project Partners would acquire in part or in full and the subsurface easements for the Preferred Alternative. This includes properties to be used temporarily during construction as well as permanent acquisitions. NJ TRANSIT would acquire the properties in New Jersey on behalf of the Project and Amtrak would acquire the properties in New York on behalf of the Project. The permanent right-of-way acquisitions are summarized below.

2.5.5.1 NEW JERSEY SURFACE ALIGNMENT

The westernmost portion of the Preferred Alternative, at Allied Interlocking, is within the existing Amtrak right-of-way. Moving eastward, where the NEC alignment would be widened southward for the Preferred Alternative, the Preferred Alternative would include some permanent easements on private property:

- Permanent easements in Secaucus and North Bergen, New Jersey, on nine properties to provide permanent access for the surface alignment, to accommodate an underground storm sewer, and for permanent features of the surface alignment (including the viaduct and access road).
- An easement over the Conrail and NYSW freight railroad rights-of-way, where a new bridge is proposed as part of the Preferred Alternative.

In addition, the surface alignment would also affect a 2.5-acre wetland mitigation site established by NYSW adjacent to the Conrail and NYSW freight railroad right-of-way. On December 12, 2012, NYSW entered into a settlement agreement, including a conservation easement to the mitigation site, with the USACE to resolve claims related to NYSW's alleged failure to complete mitigation activities associated with a Department of the Army permit in 1995 (DA Permit No. 90-0679). The Preferred Alternative would affect 0.3 acres of the mitigation site, and would require that the conservation easement on that portion of the site be removed.

NJ TRANSIT has already acquired the surface parcels east of the freight railroad rights-of-way where the tracks would extend to the new tunnel portal. These parcels were proposed for the same use as part of the ARC Project.

2.5.5.2 HUDSON RIVER TUNNEL

The new tunnel component of the Preferred Alternative would require subsurface easements where it would pass beneath properties in North Bergen, Union City, Weehawken, Hoboken, and Manhattan. It would also require permanent acquisition of some property to accommodate permanent Project features. The acquisitions required would be as follows:

- Subsurface easements on a total of 118 properties in New Jersey, including in North Bergen and Union City on the Palisades and in Hoboken and Weehawken east of the Palisades.

- NJ TRANSIT has already acquired subsurface easements on 39 properties in New Jersey as part of the ARC Project that would also be used for the Preferred Alternative.
- NJ TRANSIT has also already acquired the parcels needed to accommodate the proposed Hoboken fan plant (and an easement needed to support construction at that site), since this site was also proposed as the fan plant for the ARC Project. Two of the haul route options could require additional easements or fee acquisitions on two properties. The Project Sponsor, in consultation and cooperation with the Project Partners, will select one or more haul routes after the conclusion of the NEPA process. A detailed description of the three haul routes is provided in Section 3.3.3.4 of Chapter 3, "Construction Methods and Activities."
- In New Jersey, the State of New Jersey owns the rights to land where tidal waterways are present or were formerly present; projects that require the use of such land must acquire the rights from the state through a grant or license. For the portion of the river tunnel in New Jersey, riparian rights must be obtained from the State of New Jersey.
- For the portion of the river tunnel in New York, a grant or license of land underwater is needed from the New York State Office of General Services, which authorizes use of land under water.
- In New York, permanent subsurface easements would be required for the tunnel beneath Hudson River Park and New York State and New York City streetbeds.
- In New York, private property must be acquired either in fee or by temporary and permanent easements for the below-grade Hudson River Tunnel alignment and above-grade Twelfth Avenue fan plant on Manhattan Block 675. This includes a portion or all of Lot 1 on Block 675, where the tunnel and fan plant would be located and where construction staging activities would occur; and a portion of Lot 12, which would be used for construction staging.
- In New York, an existing easement would be used for the fan plant in space beneath and within the building at 450 West 33rd Street; this easement would be modified if necessary.
- In addition, a permanent easement for the below-grade Hudson River Tunnel alignment and a temporary easement would be required on a portion of Hudson River Park, including the West 30th Street Heliport property.

2.5.5.3 TEMPORARY USE OF LOT 12 ON BLOCK 675

Based on current preliminary design, the western portion of the property fronting on West 29th Street adjacent to the Twelfth Avenue fan plant site would be used for construction staging for the duration of the tunnel construction (see Chapter 3, "Construction Methods and Activities," Section 3.3.7.3). This property is part of Lot 12 of Manhattan Block 675 (Figure 4-4 in Chapter 4, "Analysis Framework" provides a tax lot map for Block 675). This portion of Lot 12, which extends 126 feet along West 29th Street, is part of the site where a residential development, 601 West 29th Street, is currently in construction. The 126-foot-long western portion of Lot 12 is in use for construction staging for the residential building and ultimately will house either a garage or a one-story station for Fire Department of New York (FDNY) Emergency Medical Services (EMS) ambulances.

While the completion schedule for the potential EMS facility or garage is not known, the seven-year construction schedule for the Preferred Alternative would be likely to delay completion of the EMS facility or garage. In that case, the Hudson Tunnel Project may include completion of the shell of the potential EMS facility or garage for incorporation into the development project at 601 West 29th Street, if agreed to by the developer.

2.5.6 REHABILITATED NORTH RIVER TUNNEL

The primary purpose of the Project is to rehabilitate and upgrade the North River Tunnel. As described in Chapter 1, "Purpose and Need," during Superstorm Sandy, seawater inundated both tubes of the North River Tunnel, with water levels above the height of the bench walls at the tunnel's lowest point. While the tunnel was restored to service and is now safe for travel, chlorides from the seawater remain in the tunnel's concrete liner, bench walls, and ballast, causing ongoing damage to these elements as well as embedded steel, track and third-rail systems, and signaling, mechanical, and electrical components. The North River Tunnel is more than 100 years old and was designed and built to early 20th-century standards; the tunnel's age in combination with the damage caused by flooding result in the need to upgrade systems and infrastructure throughout the tunnel.

Once the new tunnel is completed and in operation, the Project Sponsor, in cooperation with the other Project Partners, would rehabilitate and modernize the North River Tunnel. Such work would include the following:

- Portal-to-portal replacement of the bench walls to: 1) ensure that the North River Tunnel can meet modern safety standards for emergency egress and for access for maintenance and first responders; 2) provide protection for high-voltage feeder cables and signal and communication cables; and 3) provide for long-term integrity of the rail system;
- Localized repairs on the existing tunnel lining as needed to address leaks, cracks, and spalls, including areas that are currently inaccessible beneath the ballast and behind the bench walls;
- Replacement of the ballasted trackbed with a new direct fixation track system and track drainage system; and
- Installation of new or rehabilitated systems, including signal, overhead contact system, communications, traction power, and fire-life safety.

In addition, the rehabilitation would include modifying the track alignment and profile to improve ride quality, maximize drainage, and optimize side and overhead catenary clearances, all of which are currently substandard. These are described in more detail in the sections below.

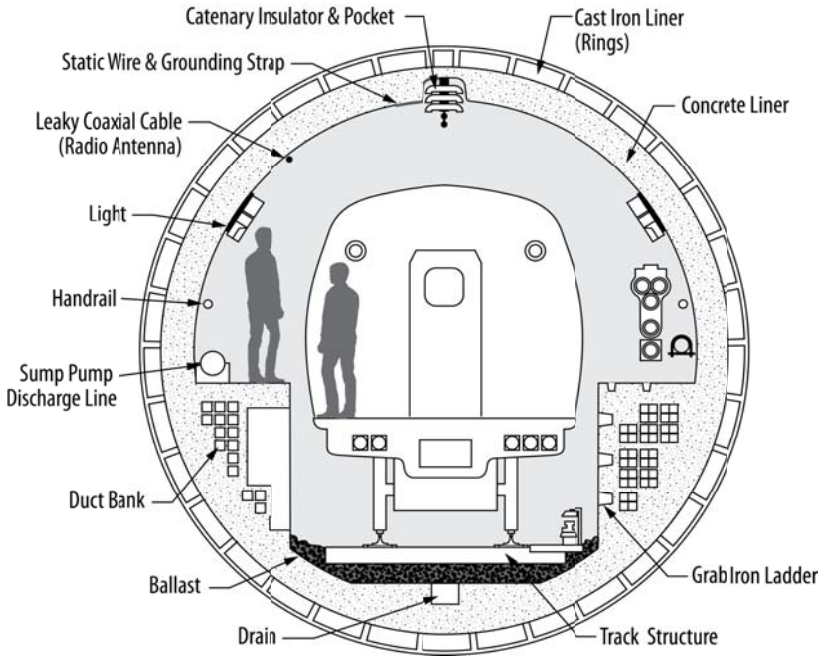
2.5.6.1 TUNNEL DESIGN

The North River Tunnel consists of two single-track tubes, running from a portal in North Bergen, New Jersey, just east of Tonnelle Avenue and continuing beneath the Palisades, Weehawken, and the Hudson River. In Manhattan the tunnel crosses through the existing Hudson River bulkhead's foundation, continues beneath the LIRR's West Side Yard, and emerges at a portal just east of Tenth Avenue, where it connects to the approach tracks to PSNY. Ventilation shafts and emergency access points are located in Weehawken (within the Lincoln Tunnel Helix) and at Eleventh Avenue within the West Side Yard.

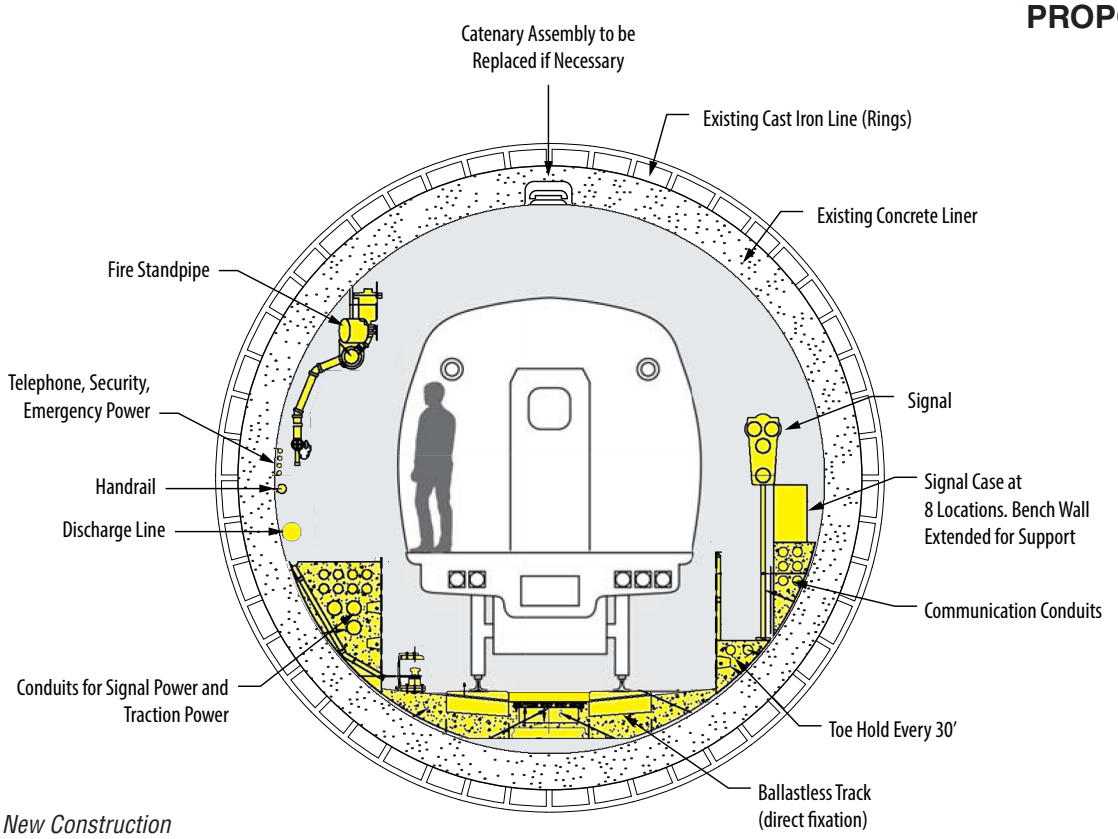
The North River Tunnel's design varies along the alignment, based on geologic conditions. Typically, the tunnel consists of a cast iron outer ring and an inner concrete lining (i.e., tunnel walls) about 2 feet thick. Concrete bench walls approximately 5 feet 10 inches above top of rail run along both sides of the trackbed, housing electrical wiring, utility cables, and other essential equipment and providing a path for maintenance workers, as well as emergency egress. **Figure 2-14** provides an illustration of the existing tunnel cross section and proposed cross section after rehabilitation.

3.30.21

EXISTING



PROPOSED



HUDSON TUNNEL PROJECT

North River Tunnel: Existing and Proposed Cross Section

Figure 2-14

2.5.6.1.1 Tunnel Liner

Overall, the concrete liner in the North River Tunnel's two tubes is in good condition. Minor cracking and spalling in the tunnel's concrete liner would be repaired. Once the bench walls and trackbeds are removed, the areas of the tunnel liner behind the bench walls and beneath the tracks and ballast would also be repaired.

2.5.6.1.2 Bench Walls

The most serious damage to the North River Tunnel from Superstorm Sandy affected the concrete bench walls, which run the length of the tunnel and provide emergency egress and maintenance access to trains and track. Ducts housed inside the bench walls contain electrical wiring, utility cables, and other essential equipment. During the storm, seawater rose to above the top of rail for approximately 3,200 feet of the tunnel's north tube and 2,300 feet of the south tube. The flood level reached above the height of the bench walls at the tunnel's lowest point. About 1,900 feet of bench wall in the north tube and 800 feet of bench wall in the south tube were inundated. As a result of the seawater inundation, the bench walls have longitudinal cracks, severe spalls with exposed steel, and corrosion of embedded steel elements. As a result of steel corrosion that has caused the concrete to spall, the continuous bench walls and duct work cannot perform reliably or be repaired. While the tunnel is structurally sound and safe for continuing passenger rail use, these conditions necessitate that the existing bench walls be replaced. These new walkways should be constructed at the proper height to meet current fire-life safety standards (National Fire Protection Association (NFPA) 130). This replacement should occur portal to portal, since it is not practical to construct the middle portion of a bench wall at different height than the two ends, given that the bench wall operates as one continuous system providing emergency egress.

As part of the tunnel rehabilitation, the bench walls would be demolished and replaced, portal to portal, including protection for high-voltage feeder cables and signal and communication cables where appropriate. The new replacement would be designed to meet the requirements of NFPA 130 and would have one high egress walkway, level with the train floor (4 feet above top of rail), on the inner tunnel wall (i.e., the wall closest to the tunnel's other tube). The high egress walkway could be used as an emergency walkway for passengers if a train must be evacuated and would connect to the cross passages between the North River Tunnel's two tubes. The other egress walkway (along the outside tunnel wall) would be low, slightly above the top of rail, to provide easy access to the tracks and underside of trains for emergency responders and railroad personnel. The low egress walkway would enable inspection and repairs, safe clearance for workers, and access to decouple a stopped or disabled train.

2.5.6.2 TRACK

The existing rail system in the North River Tunnel consists of rock ballast, treated timber ties, running rail, and third rail. These components are now coated with chlorides remaining from the seawater that flooded the tunnel. Full removal of the chlorides from the ballast, including from the inaccessible surfaces, is not possible; therefore, the ballast would be removed in its entirety. The tie and rail systems have to be removed in order to remove the ballast.

The track system and ballast in the North River Tunnel would be replaced in its entirety with a direct fixation rail system using low vibration track, which is the state of practice for rail tunnels. Direct fixation track systems generally provide better track stability, reduced maintenance requirements, and increased service life relative to ties and ballast. In addition, a direct fixation track system would provide an opportunity for vibration reduction and would reduce stray current where appropriate.

2.5.6.3 DRAINAGE

The drainage system in the North River Tunnel would be replaced and upgraded. The new drainage system would supplement the new pumps installed after Superstorm Sandy and would include adequate drainage structures and facilities (such as track bed drainage and discharge lines) to handle normal infiltration and anticipated inflows. The new tunnel drainage system would not be designed to keep the tunnel dry during a storm event such as Superstorm Sandy, due to the physical limitations of existing pump rooms and tunnel geometry that limits the size of discharge piping. Instead, the pumps have been hardened as part of a separate project so that they will continue pumping water during a flooded condition.

2.5.6.4 UTILITIES

Utilities in the tunnel, including those in the bench walls and those mounted on the tunnel walls, would be replaced or upgraded, as appropriate. Existing utilities that are in good condition would be retained as is. In addition, a new fire protection system would be provided.

2.5.6.5 TUNNEL VENTILATION

No changes to the tunnel ventilation system are proposed as part of the rehabilitation.

2.5.6.6 POWER

The tunnel's overhead contact system, installed in the tunnel ceiling, would be replaced and rehabilitated to a state of good repair. Traction power feeders and third rail will also be replaced during construction.

The existing North River Tunnel has backup power for lighting, pumps, fire alarms, security, communications, and fans that would remain in place.

2.5.6.7 SIGNALS AND COMMUNICATION SYSTEMS

The signal system within the North River Tunnel would be fully replaced and upgraded to the same configuration as the new tunnel, except that the North River Tunnel does not have vent zones and therefore would not include vent zone signals. In addition, new communication systems equipment would be installed. The new signal system, working in conjunction with the communication systems, would be a Positive Train Control (PTC) system as is the current system.

2.5.6.8 SAFETY AND SECURITY / EMERGENCY ACCESS

Cross passages are located approximately every 100 feet between the two tubes of the North River Tunnel in the hard rock section of the tunnel beneath the Palisades and another cross passage is located at the Manhattan shoreline. No cross passages are located in the section of the tunnel beneath the Hudson River. Emergency access is available at the tunnel's portals and at its two ventilation shafts—one in Weehawken and one at Eleventh Avenue in Manhattan.

The rehabilitated tunnel would have egress walkways for emergency access to and from the tunnel. In each tube, one walkway would be at the same height as the train doors and would connect to the tunnel cross passages so that in an emergency, passengers could exit the train using the walkway to reach the cross passages/emergency access points.

2.5.6.9 RESILIENCY / FLOOD PROTECTION

As already noted in this chapter, during Superstorm Sandy, seawater entered the North River Tunnel from Manhattan, through the tunnel portal at Tenth Avenue and the ventilation shaft at Eleventh Avenue once the West Side Yard was inundated. As discussed above in Section

2.5.4.5, LIRR is undertaking a perimeter protection project for the West Side Yard to protect the yard from future flooding. LIRR is designing this wall to a DFE of four feet above the BFE, meaning that the new perimeter wall will withstand floods that are four feet higher than the currently projected 1 percent probability storm elevations. By preventing floodwaters from entering the West Side Yard, the perimeter wall will protect the North River Tunnel from future flooding.

In addition, the Project Sponsor, in cooperation with the other Project Partners, would harden the drainage system in the North River Tunnel to continue operating during a flooded condition. Amtrak has already hardened the pumping systems in the North River Tunnel so that they would continue to operate in the event of tunnel flooding. In addition, as part of the rehabilitation with the Preferred Alternative, the Project Sponsor, in cooperation with the other Project Partners, would relocate electronic control systems out of the tunnel to locations that are protected from flooding, and install electronics and cables within the tunnel that are more flood-resilient. These measures would allow for faster recovery in the event of tunnel flooding, avoiding the type of damage that resulted from Superstorm Sandy.

While the Weehawken ventilation shaft leading to the North River Tunnel was not flooded during Superstorm Sandy, to protect the Weehawken ventilation shaft against future flooding during a severe storm, Amtrak is planning to implement a smaller standalone project or install deployable flood barriers at this ventilation shaft. Amtrak will undertake this floodproofing project as a separate project from the Preferred Alternative, as part of Amtrak's regular capital maintenance program. Amtrak will complete the Weehawken shaft floodproofing project no later than by completion of the North River Tunnel rehabilitation. Amtrak's standalone Weehawken shaft floodproofing project will be designed to a DFE of five feet above BFE.

2.5.7 RAIL OPERATIONS

Consistent with the Project purpose and need, the Preferred Alternative would preserve the current functionality of Amtrak's NEC service and NJ TRANSIT's commuter rail service between New Jersey and PSNY by repairing the deteriorating North River Tunnel. Once complete, it would strengthen the NEC's resiliency to support reliable service by providing redundant capability under the Hudson River for Amtrak and NJ TRANSIT NEC trains between New Jersey and the existing PSNY.

2.5.7.1 INTERIM OPERATIONS WITH NEW TUNNEL COMPLETE AND NORTH RIVER TUNNEL BEING REHABILITATED

Once the new Hudson River Tunnel is complete (estimated for 2030), passenger rail service would shift to use the two tubes of the new tunnel, and rehabilitation of the North River Tunnel would occur one tube at a time. Both tubes of the North River Tunnel would not be closed simultaneously for rehabilitation because the new tunnel's two tubes alone, without either North River Tunnel tube, would not provide the same level of peak-hour capacity as the North River Tunnel does today. While the new Hudson River Tunnel would have the capacity to accommodate at least 24 trains per hour in each direction, track restrictions at PSNY and elsewhere on the NEC between Newark, New Jersey and PSNY would limit train throughput between the tunnel portal east of Tenth Avenue and the PSNY station tracks for the two tubes of the tunnel when both tubes are in operation. Unlike the North River Tunnel, because of its connection to the existing track system, the new Hudson River Tunnel would not have parallel route connections for eastbound and westbound trains to move concurrently between the tunnel tracks and all platform tracks, and the delays that would result from trains waiting to use the single-track I Ladder would reduce capacity. To avoid the reduction in capacity that would otherwise occur, one tube of the North River Tunnel would remain open while the other is being

rehabilitated, so that three tubes would be available at all times and Amtrak and NJ TRANSIT could continue to operate a total of 24 trains per hour in each direction during the peak hour.

A specific operating plan for Amtrak and NJ TRANSIT's use of the three tubes during rehabilitation of the North River Tunnel has not yet been developed. Amtrak and NJ TRANSIT have developed and modeled representative operating plans to confirm the feasibility of this approach. Both railroads plan to operate at full capacity, as they do today, consistent with the goals for the Hudson Tunnel Project.

2.5.7.2 OPERATIONS WITH BOTH TUNNELS COMPLETE

When the Hudson Tunnel Project is complete and both the North River Tunnel and new tunnel are in service in 2033, a total of four tracks would be available for the Hudson River crossing between New Jersey and New York. Amtrak and NJ TRANSIT's NEC service between New Jersey and New York would benefit from redundant capability and increased operational flexibility for future regular maintenance activities as well as during emergencies.

All four tracks would connect to PSNY platform Tracks 1 through 18, with the North River Tunnel tracks also having access to Track 19. Eastbound trains leaving Secaucus and westbound trains leaving PSNY could each be routed on two different tracks, providing increased operational flexibility. The existing North River Tunnel would continue to have a capacity of 24 trains per hour and the new Hudson River Tunnel would have a capacity within the tunnel of at least 24 trains per hour in each direction, although track restrictions at PSNY would limit train throughput between the tunnel portal east of Tenth Avenue and the PSNY station tracks for the two tubes when both are in operation. A specific operating plan for Amtrak and NJ TRANSIT's use of the two tunnels together has not yet been developed.

While the Project addresses maintenance and resilience of the NEC Hudson River crossing, it would not increase rail capacity, which would remain constrained at PSNY and elsewhere on the NEC between Newark, New Jersey and PSNY. As noted above in the discussion of the No Action Alternative (Section 2.4), PSNY currently operates at capacity during the peak periods—there is no additional capacity to process trains at the platforms, given the time required for trains to wait at the platform for passengers to board and alight, and to move through the station. In addition, no peak-period capacity is available to route additional trains through the East River Tunnels for revenue service or midday storage in Sunnyside Yard, and there is limited storage capacity within the PSNY complex. Ultimately, an increase in service between Newark Penn Station and PSNY cannot be realized until other substantial infrastructure capacity improvements are built, such as an expansion at PSNY, midday storage, and additional tracks over the Hackensack River. Therefore, this EIS assumes that when the Preferred Alternative is completed in 2033, Amtrak and NJ TRANSIT would operate the same number of peak-period trains using the four tracks beneath the Hudson River as in the No Action Alternative, when only two tracks would be available. Nonetheless, the new Hudson River Tunnel is being designed with a capacity of at least 24 trains per hour, which can be fully achieved once capacity constraints at PSNY are addressed as a separate initiative from the Hudson Tunnel Project.

2.5.8 ESTIMATED PROJECT COST

The estimated construction cost to complete the new Hudson River Tunnel is $9.22 billion, and the estimated construction cost to rehabilitate the North River Tunnel is $1.81 billion. These costs are based on conceptual engineering and are escalated to the year of expenditure. The total construction cost estimate includes costs related to design and engineering, construction, right-of-way acquisition, a 10 percent contingency, and other related Project costs, but excluding

finance charges. These estimated costs will continue to be refined as engineering and design continue.[14]

2.5.9 SCHEDULE FOR PROJECT COMPLETION

As discussed in Chapter 1, "Purpose and Need," a new Hudson River crossing on the NEC is urgently needed to maintain existing service. Because of the importance of the North River Tunnel to essential commuter and intercity passenger rail service between New Jersey and New York, the Project needs to be accomplished as soon as possible. Based on preliminary engineering, the new Hudson River Tunnel would be complete in 2030 and the rehabilitated North River Tunnel would be back in service for passenger rail operations in 2033.

2.6 PREFERRED ALTERNATIVE WOULD NOT PRECLUDE FUTURE CAPACITY EXPANSION PROJECTS

The Project is being developed in the context of two overarching programs intended to improve operations on the NEC, including long-term improvements to the NEC through the NEC FUTURE program, and increasing capacity on the section of the NEC between Newark, New Jersey and PSNY through the Gateway Program. In recognition of this context, Goal 4 of the Hudson Tunnel Project, as described in Section 1.5, "Goals and Objectives," of Chapter 1, "Purpose and Need," is to not preclude future trans-Hudson rail capacity expansion projects. Objective 4.1 for the Project is to allow for connections to future capacity expansion projects, including connections to Secaucus Junction Station through to the Portal Bridge over the Hackensack River, and connections to station expansion projects in the area of PSNY. In order to meet this goal, the Project would not preclude any elements of these programs:

- **NEC FUTURE:** In 2012, FRA launched NEC FUTURE to consider the role of rail passenger service in the context of current and future transportation demands and to evaluate the appropriate level of capacity improvements to make across the NEC. The purpose of the NEC FUTURE program is to create a comprehensive investment plan to improve current and future intercity and commuter passenger rail service along the NEC rail corridor between Washington, D.C., and Boston, Massachusetts. With the NEC FUTURE Selected Alternative, FRA proposed a series of investments to upgrade aging infrastructure and improve the reliability, capacity, connectivity, performance, and resiliency of passenger rail service on the NEC, while promoting environmental sustainability and economic growth. FRA initiated NEC FUTURE in early 2012, released a Tier I Final EIS in December 2016, and released a Record of Decision in July 2017. The Selected Alternative consists of an investment program that grows the role of rail by identifying numerous upgrades and state-of-good-repair projects along the length of the NEC. The NEC FUTURE Selected Alternative includes a new two-track tunnel under the Hudson River into Midtown Manhattan.
- **Gateway Program:** The Gateway Program is a comprehensive program of phased strategic rail infrastructure improvements to preserve and improve current services and create new capacity on the NEC. The objective of the Gateway Program is twofold: (1) to update and modernize existing infrastructure and repairs to infrastructure elements that are damaged

[14] This cost estimate is updated from the cost that was provided in the DEIS, and is escalated to estimated year of expenditure, rather than to midpoint of construction as was done in the DEIS cost estimate. In addition, this cost estimate is different from the estimates that the Project Partners submitted to FTA in August 2020 as part of the Financial Plan accompanying their Hudson Tunnel Project Capital Investment Grants (CIG) application due to a variety of factors such as (i) the CIG project includes costs ($532 million) associated with the third section of the Hudson Yards Right-of-Way Preservation Project, and (ii) the CIG financial plan includes finance charges.

due to age or events such as Superstorm Sandy, and (2) to increase track, tunnel, bridge, and station capacity, eventually creating four mainline tracks between Newark and PSNY to allow the doubling of passenger trains in this section of the NEC. The individual projects that make up the Gateway Program will advance through planning, environmental review, funding, and construction separately; some of these projects are approved for construction while others are in the planning stages.

As described in Chapter 1, "Purpose and Need," the Project addresses a specific need stemming from the deterioration of the existing North River Tunnel and therefore is considered independently from the capacity-enhancing projects analyzed in NEC FUTURE and proposed in Gateway Program planning documents. The Preferred Alternative addresses maintenance and resilience of the NEC Hudson River crossing and would not independently increase rail capacity. Although the Project may be an element of a larger program to expand rail capacity, it is a separate project from any larger initiative that would meet an urgent need to preserve existing service and is being evaluated accordingly. Therefore, ultimately, no increase in train service between Newark Penn Station and PSNY could occur until other substantial infrastructure capacity improvements, such as those considered as part of NEC FUTURE or the Gateway Program, are built in addition to the four trans-Hudson tracks that will be in place at the completion of the Project. Those improvements would be the subject of one or more separate design, engineering, and environmental reviews. (For additional discussion of the Hudson Tunnel Project's relationship to future capacity enhancements on the NEC, see Chapter 20, "Indirect and Cumulative Effects," Section 20.8.) Nonetheless, the Preferred Alternative would not preclude other future projects to expand rail capacity in the area. ✷